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MARKET REACTION TO PUBLIC INFORMATION

Evidence from listed football clubs

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Sirpa Väisänen
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Tarkastajat:
KTT Matti Keloharju ja
KTT Matti Suominen

Helsingin kauppakorkeakoulu
Pro Gradu –tutkielma
Sirpa Väisänen

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TUTKIELMAN TARKOITUS

Tämän tutkielman tarkoituksena on kerätä empiiristä todistusaineistoa informaation vaikutuksesta osakkeiden hintoihin tutkimalla, kuinka markkinat reagoivat pörssilistattujen jalkapalloseurojen otteluihin ja valmentajavaihdoksiin. Informaation odotettavuutta mitataan kiinteillä vedonlyöntikertoimilla. Tutkielmassa tarkastellaan odotetun ja odottamattoman informaation sekä hyvien ja huonojen uutisten vaikutusta sekä vedonlyöntimarkkinoiden ja osakemarkkinoiden integraatiota. Lopuksi tutkitaan joukkuemenestyksen vaikutusta valmentajavaihdoksiin.

AINEISTO

Tutkimusaineisto koostuu pelituloksista, vedonlyöntikertoimista ja päivittäisestä osakeinformaatiosta (kaupankäyntivolyymi, markkina-arvo, osakkeiden lukumäärä, päivän ensimmäinen, viimeinen, alin ja ylin osakekurssi) 32 pörssilistatulle jalkapalloseuralle seitsemästä Euroopan maasta ja paikallisten osakemarkkinaindeksien hinnoista ajalla 1.8.1998 – 12.4.2004. Tutkielmassa käytetään myös tilinpäätös- ja valmentajavaihdostietoja.

TULOKSET

Sijoittajat käyvät kauppaa otteluiden perusteella. Kaupankäyntivolyymi on korkeampi kauden aikana. Volyymi ja volatiliteetti ovat korkeampia pelejä seuraavina kaupankäyntipäivinä kuin muina päivinä. Osaketuotot kuvastavat epäsymmetrisesti pelituloksia. Häviön negatiivinen vaikutus osaketuottoihin on suurempi kuin voittojen positiivinen vaikutus. Putoaminen eurooppalaisista ja kansallisista cupeista sekä alemmalle sarjatasolle putoamiseen liittyvät pelit vaikuttavat ylituottoihin tavallisia pelejä enemmän, mutta ylemmälle sarjatasolle nousemiseen liittyvät pelit eivät vaikuta tilastollisesti ylituottoihin. Markkinat reagoivat sekä odotettuun että odottamattomaan tulokseen.

Tulokset informaation vaikutuksesta volatiliteettiin tukevat yksityisen informaation hypoteesia koko otoksen ja englantilaisten ja skotlantilaisten seurojen osalta. Otos muista seuroista sen sijaan osoittaa, että sijoittajat käyvät kauppaa julkisen informaation perusteella. Pelimenestys vaikuttaa positiivisesti valmentajasuhteen kestoon, mutta markkinat eivät reagoi merkittävästi valmentajavaihdokseen julkistamispäivän yhteydessä.

AVAINSANAT

Informaatiovaikutukset, markkinoiden tehokkuus, julkinen informaatio, jalkapalloseurat, valmentajavaihdokset, volatiliteetti

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Abstract
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PURPOSE OF THE STUDY

The objective of this thesis is to gather further evidence on information effects on equity prices by studying the market reaction on the game and non-game events of listed football clubs. The expected value of the signal is controlled by using betting market fixed odds. The effect of expected and unexpected information, the impact of 'good' news versus 'bad' news, and the integration of betting market and stock market are investigated. Also, the relations between managerial change and prior team performance and stock market reaction around the managerial change announcement day are examined.

DATA

The data in this study comprises of game-event, betting market odds, and daily stock information (trading volume, market value, number of shares outstanding, open, close, high, and low stock prices) for a sample of 32 stock market listed football clubs from seven European countries and the prices of local market indices for the time period of August 1, 1998 to April 12, 2004. This study uses also financial statement and managerial turnover data.

RESULTS

The main finding of this study is that investors trade on the basis of games. Volume is higher during the football season and both volume and volatility are higher on post-game trading days than other trading days. Returns reflect game results, but this reflection is asymmetric. Losses are penalized more than wins are rewarded. European competitions, domestic cup games and relegation games have an even greater impact, but promotion games do not have a significant effect. The market reacts to both expected and unexpected outcome. Moderate support to the betting and stock market integration hypothesis is found.

Also, the impact of information on volatility is examined. The findings are consistent with the private information hypothesis for the pooled sample and the subsample of English and Scottish clubs. However, the subsample of clubs from other markets shows evidence that investors trade on public information. Managerial tenure and playing performance are positively related, but no significant stock market reaction around the announcement date of managerial change is found.

KEYWORDS

Information effects, market efficiency, public information, football clubs, managerial changes, volatility

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1 INTRODUCTION

Is professional football a sport or an industry? Is it an enterprise whose only profit to itself is the pleasure it gives to millions or ... is it a business which is fired by dreams of financial gain? – Alan Hardaker, former secretary of the Football League (Hardaker, 1977, 66).

The economics of professional team sports has received increasing attention in the literature in recent years. Partly this has been due to the high public profile of the industry and its growing financial importance. The interest of researchers in professional team sports has also been motivated by the peculiar economics of the industry (Neale, 1964). Sporting contests and tournaments are products, the attractiveness of which depends in part on uncertainty of outcome. The increasing research interest in professional team sports is also due to the transparency of the industry and availability of data for empirical research. The operation of professional sports teams is under intense and continuous scrutiny by fans and the media. Data on the inputs (e.g. players and coaches), outputs (e.g. match results) and financial performance are widely reported. As a consequence, the professional team sports industry offers a rich source of opportunities for empirical research on a wide range of topics. (Dawson, Dobson, and Goddard, 2000)

1.1 Objective and motivation of the study

The objective of the study is to gather further evidence on information effects on equity prices by studying the market reaction on the game and non-game events of listed football clubs. In the later half of the 1990s many football clubs acquired listing on the national stock exchange, creating a visible trend in the IPO market. As a topic studying the information effects on security prices by using football games as a proxy for public information is interesting because the signals are frequent, easy to quantify, occur when the market is closed, and there are observable ex ante expectations. The expected value of the signal can be controlled by using betting market fixed odds.

Sports provide large, reliable and readily available data sets with widely accepted measures of performance, the game results. Through the game results, there is frequent information on the performance of a company, a football club, available, while in normal circumstances the information comes once a quarter or is irregular. Game results can be seen as a proxy for the performance of the club, since the implications of winning or losing reflect directly on ticket sales and indirectly to revenues from broadcasting, merchandising and sponsorship deals. Betting market odds provide a proxy for the expectations of the performance of the club, i.e. the expected outcome, by giving the probabilities for a win, a draw, and a loss. According to finance theories, it is the unexpected outcome that matters the most and should change the trading patterns and stock prices. The significance of unexpected information has been proved, among others, by Rendleman, Jones and Latané (1982), Pearce and Roley (1983), Bamber (1986), and Datta and Dhillon (1993).

Listed football clubs and game results provide also convenient laboratory circumstances for studying the incorporation of information into the stock prices. Since games occur exclusively outside the trading hours, analyzing the listed football clubs provides insight as to when publicly available information is impounded into stock prices - whether the result is reflected in the first price or within the day (Brown and Hartzell, 2001). In essence, games represent substantial public information that is not revealed during normal business hours, unlike most macroeconomic news and earnings announcements, on which the information usually comes to the market during trading hours.

There is evidence that publicly announced and unanticipated firm-specific information affects stock prices (e.g. Malkiel, 1989) as do more frequent value-relevant signals, such as the stock price effect of quarterly earnings announcements (e.g. Joy, Litzenberger, and McEnally., 1977). Information effects on the stock price have been previously researched also by Brown and Hartzell (2001), who study the effects of Boston Celtics' game results on the firm's share returns, trading volume, and volatility. They control the expected value of the signal by using betting-market point spreads, which they, however, find having little effect on the relations between game results and return and trading activity. Playoff games affect the returns more than regular-season games. Brown and Hartzell (2001) also study the effects on non-game events: the new arena project and hiring of a new coach, and find that investors seem to be trading rather on team-related news than non-team-related news. Opening prices do not fully reflect game results, thus traders are seen as acting on private information, which is consistent with previous findings by French and Roll (1986), who show that private information is the main factor behind high-trading time volatility, but inconsistent with the conclusion of Stoll and Whaley (1990) that public information is primarily responsible for higher open-market volatility.

For the thesis, I analyze a sample of game results, historical betting market odds, trading volume, returns and volatility for 32 European football clubs from August 1, 1998 to April 12, 2004. The managerial change and team performance sample consists of 75 changes in 25 stock market listed football clubs during March 1998 – October 2005. Also, 79 managerial changes in 24 football clubs during the time period of August 1998 – March 2004 are studied in relation to stock market reaction in their share prices.

1.2 Research questions

The main research questions of the thesis are whether the market reacts to information that is frequent (at least once a week), what the size of the impact is, how they react and when. It is tested if the investors rational in the sense that they react most to the information that has direct, observable impact to the cash flows. It is also interesting to investigate the efficiency of the market by analyzing whether the reaction to unexpected information is greater than to expected information, and whether there is a symmetric reaction to positive and negative news, both expected and unexpected. In terms of managerial turnover it is examined whether there is a relation between managerial change and prior team performance, and whether stock market reacts to the management changes.

1.3 Contribution

Listed football clubs provide an interesting opportunity to find further evidence about the incorporation of publicly available information by the markets. As in the study by Brown and Hartzell (2001), the signals (game results) are frequent and take place outside the trading hours. This thesis differs from the study by Brown and Hartzell (2001) in the following ways: the number of companies in the sample is greater, the data and the markets are European, football allows for three different outcomes: win, draw, loss (basketball for two), and the sample for the non-game event studied, managerial changes, is greater. Furthermore, the effect of team performance on managerial turnover is investigated in the thesis. Instead of point spreads, betting market fixed odds are used as a proxy for the expectations of the investors. Unlike in major league sports, such as basketball and ice hockey, there are no playoffs to decide the championship of the top division (e.g. the FA Premier League). Thus, as in the study by Dobson and Goddard (2001), domestic and international cup competitions, such as UEFA Champions League, are studied to a large extent. Also the relegation and promotion events are investigated due to their implications to future cash flows. As a study about football clubs in particular, this study aims for a versatile investigation of the links between performance on pitch and on stock market, and the impact of management turnover.

1.4 Terms and definitions

This subchapter briefly introduces the terms and definitions used in the study.

Odds are the likelihood of an outcome occurring, stated in number form. The 'straight up' outcome is typically the basis of the wager, without regard to a point spread. Odds are often stated as a money line.

Betting-market point spreads are used to even the odds of a particular sporting event. Each team has points either added to its score, or subtracted from its score, to determine if the bet is a winner. Point spreads are set by bookmakers to balance the dollar amount bet on each team, thus minimizing their risk and guaranteeing their revenue, which comes from charging a percentage of losing bets. (Camerer, 1989)

Football fixed odds match betting is also known as 1X2 betting. On fixed odd coupons, a '1' denotes the home team, with the away team represented by a '2' and the draw by an X. In standard match bets between two teams, winning odds are available for both, and the wager will either win or lose depending on the outcome of the event. Since a significant proportion of games end without any winner, the 'draw' is offered as a betting option. This means that if the match is drawn, only 'draw' bets will win, and bets on either team to win will not be due any return. (Buchdahl, 2003)

On season is the time of the year when matches are played. Varies between the countries. For England and Scotland the on-season is from mid-August to early May.

Off-season is the time of the year when matches are not played. Also varies between the countries. For England and Scotland the off-season is from early May to mid-August.

League position is the ranking of a club in the league during a season. The hierarchical structure of many European domestic leagues enables the ranking of clubs in all division levels. For example, in English football there are currently 92 teams in the FA Premier League and the three divisions of the Football League. It is possible to rank teams from 1 to 92, with top place in the FA Premier League ranked first and bottom place in Division Three of the Football League (currently called the Football League Two) ranked last (Szymanski and Smith, 1997; Dawson et al., 2000).

Public information is objectively evaluated and usually revealed during business hours. In the case of game results, which are considered public information, the information is revealed outside trading hours.

Private information is subjectively evaluated.

Noise trading is a compulsive or hyperactive trading done even in the absence of meaningful new information. Noise traders usually do not 'filter' real information from 'noises'. Such market noises usually take the form of minor zigzags in market prices and volumes. Noise traders interpret those random noises as mispricing that offer arbitrage opportunities or signals of short price trends to be followed. The other form for market noises is the 'daily chatter' of financial medias, tip givers and sellers.

Profit maximization is the process by which a firm determines the price and output level that returns the greatest profit.

Utility maximization: utility is a measure of the happiness or satisfaction gained consuming good and services.

1.5 Structure of the study

The remainder of this study is organized in the following way: The next chapter reviews some features of the sports business, especially football and the previous research related to it. Chapter 3 discusses the previous research and literature on Efficient Market Hypothesis, betting market efficiency, the arrival of information, and management turnover. Chapter 4 discusses and develops the nine hypotheses of the study. Chapter 5 describes the data, and Chapter 6 presents methodology and defines the variables. Chapter 7 presents the empirical results of this study and discusses the findings in relation to the hypotheses. Finally, Chapter 8 concludes with the summary of findings and suggestions for further research.

2 CHARACTERISTICS OF FOOTBALL BUSINESS

For many decades the national team was the pinnacle of footballing achievement. Although the World Cup remains the premier football event, the balance of power has now shifted from international football to club football. Clubs like Manchester United, Chelsea FC, and

Juventus have gained international status in their own right, initially through the advent of European club competitions, subsequently through developments in television and other technology. Especially in the 1990s football clubs enjoyed considerable increases in income from merchandising, sponsorship, television and higher prices at the grounds. Szymanski (1998a) stresses the opportunities of business strategy learnings from football. Competition in football is highly structured and the results of competition are clearly measurable. Outcomes are measurable not just in financial terms but in terms of success on the pitch, through games won and lost, league positions achieved and trophies won. According to Szymanski, few other industries produce such clear indicators of who are the winners and who are the losers.

This chapter presents a number of key features of sports, especially football, business particularly related to this thesis and reviews some of the interesting empirical findings in the economics of sports. Some of the empirical literature investigates phenomena in other sports than football, but the findings can be considered interesting also from the perspective of football business and, to some extent, applicable.

This chapter is organized as follows. First, some general aspects of football business are presented, namely league structure, revenues, the labor and transfer markets, followed by discussion on competitive balance and uncertainty of outcome. The third subchapter address the issue of team performance and its effect on revenues and profits. The fourth subchapter discusses the role of football manager, after which the evidence from the studies on the relation of managerial change and team performance is presented. This chapter concludes with the discussion on ownership of football clubs and the listings to the stock market.

2.1 Professional football: key elements of economic structure

Sports teams are similar to other enterprises in attempting to provide a 'product' (a victory) by employing and combining various inputs (the skills and other characteristics of the team members)[1]. In professional team sports, a single contest can be viewed as analogous to a factory production run (Zak, Huang, and Siegfried, 1979). Output in team sports is conventionally measured in terms of team success as exhibited in winning performance. The

[1] The question as to whether it is an individual team (club) or the entire league which should be viewed as analogous to the firm has been the subject of a long standing debate in the literature on the economics of sport. See, for example, Neale (1964), Demmert (1973), and Sloane (1971) for an association football context.

inputs into the production process are reflected by the performances of team players, which are themselves dependent on such factors as inherent ability or talent, physical characteristics, form, experience, and fitness. Team success can be also affected by the club management who, in addition to coaching, preparing and motivating teams and maintaining team morale, are responsible for an array of decisions that can directly affect the outcome of individual games on the day as well as eventual seasonal outcomes, e.g. purchase and sale of players to reconstitute squads, team selection, match tactics and in-game substitutions. (Carmichael and Thomas, 2000)

Professional football's characteristics as a sport have always been linked with its attributes as a business, but even more so at present. Complaints are expressed regularly in the media and elsewhere that players are over-paid; that the transfer market is out of control; that shareholders' priorities are overriding the interests of supporters; that excessive ticket prices are driving long-term supporters away from football; and that the priorities of television are dictating both the strategic and the operational decisions of football clubs and the sport's organizing bodies. Horton (1997) and Conn (1997) voice typical supporters' concerns over a wide range of matters of this kind, all of which are essentially issues of economics, commerce, or finance.

This subchapter presents an overview of club football. The contents will serve as a background to the more detailed analyses of various aspects of the economics of sport and professional football, which are discussed in subsequent subchapters. Section 2.1.1 presents the English league, from which most of the sample clubs in this study are, as an example of a football league. Section 2.1.2 describes the revenue structure in football business. The main component of a football club's costs is expenditure on players, through both wages and transfer fee expenditure and thus, Section 2.1.3 provides an account of the development of football's labor and transfer markets.

2.1.1 The English football league

The Football Association (FA) was established in 1863 (Szymanski and Kuypers, 1999, 3). The principle of professionalism was accepted by the FA in 1885. Its recognition was a key development in the processes leading to the eventual formation of the English Football League in 1888. The Football League grew to the size of 92 teams by 1951 and was organized into four divisions, with membership decided by merit rather than geographical location by 1959. Aside from some divisional, relegation, and promotion adjustments the Football League remained as such until the withdrawal of Division 1 teams from the Football League to form a breakaway Premier League in 1992. This development has not affected professional football's basic competitive structure, but it has had profound organizational and financial implications. (Dobson and Goddard, 2001)

Before the breakaway of Premier League, the Football League was a mature industry with very characteristic problems. It had to deal with declining demand and competition from other leisure products. Most firms made losses and heavy investment was required both to meet safety standards and to improve the quality of the product sufficiently to compete. Firms in this industry have little control over their main input cost, players. Obstacles to take-over and acquisition allow current owners to follow non-profit objectives, allow small groups to veto changes which might be in the general interest. In the case of English Football, the Taylor Report, which obliged clubs to invest in all-seater stadia modernizing the facilities and making them more attractive to spectators, and the broadcasting deals have provided a focus for coordination. (Szymanski and Smith, 1997)

The English Premier League thus replaced what was previously the top (First) division of the four divisions English Football League. It is regulated by the Football Association (FA) and run separately from the three divisions which now comprise the Football League. The FA Premiership and the First Division of the Football League (called the Championship) are linked by the traditional system of promotion and relegation at the end of each season, which sees three teams promoted and relegated between the Premier League and the Championship (Division 1), and the Championship and Football League 1 (Division 2), while four teams are promoted and relegated between Football League 1 and 2 (Division 3). End of season positions are determined by the total number of points accumulated from the results of individual matches, with three points awarded for a win and one for a draw, together with (in case of equal total points) a comparison of total goals scored for with the total number of goals scored against.

The season extends from mid-August until early May with each team playing each other on a home and away basis. While Saturday remains as the main match day with a fairly full program of fixtures on most Saturdays during the season, the advent of live satellite TV coverage has produced changing schedules featuring regular Sunday afternoon and Monday night fixtures. Full fixture rounds are occasionally scheduled for midweek, with individual midweek matches (often rescheduled due to postponement of the original fixture due to weather conditions or other commitments by the teams involved) scattered throughout the season. While the team topping the Premiership at the end of the season are crowned champions and qualify directly for the European Cup (also called the Champions' League) competition in the following season, a number of other highly placed clubs also qualify for European competitions. While the result of each fixture contributes to the eventual and overall competitive outcome at league level, certain matches have particular or specific competitive features such as those which characterize highly charged 'derby' matches between local and traditional rivals. In addition to the league tournament, the teams play in knockout tournaments, such as the domestic cups. The Premiership teams play in the English League Cup and the prestigious FA Cup. (Carmichael and Thomas, 2000)

Changes in both the financial structure and the organization of professional league football in England and Wales have increased discussion about the extent to which a relative increase in the financial power of a small group of elite clubs at the top end of the league structure creates a tendency for playing success also to be concentrated increasingly among the same group of clubs. The former division 1 clubs breaking away from the Football League and forming Premier League is seen as an indication of such development, as the Premier League is considered to be much more effective than the former Football League in exploiting commercial opportunities in the areas of sponsorship, merchandising, and the sale of television rights. (Dobson and Goddard, 1998)

2.1.2 Revenue structure in football business

Since the late 1970s there has been a significant shift in the relative importance of football clubs' revenue sources. The importance of gate receipts has declined significantly as developments in other industries such as merchandising and broadcasting have created new opportunities (Szymanski and Kuypers, 1999, 37). The revenues that have flowed into top-level football in the last decade are of a quite different magnitude to what has gone before. This new-found prosperity has significant implications not only for clubs' business approaches and strategies, but also more fundamentally for how leagues operate in terms of concepts like competitive balance and uncertainty of outcome. (Morrow, 2003, 2)

In the present-day world of highly lucrative television contracts, merchandising, and sponsorships, gate receipts from supporters attending the matches still constitute a significant proportion of the total revenues of most football clubs. Furthermore, spectators who attend matches in person are not just passive consumers. Their presence contributes in a fundamental way to the quality of the product, by generating atmosphere and a sense of occasion. Most spectators also seek to influence match outcomes through the effect of vocal encouragement and criticism of players, managers, and match officials. For these reasons, as well as the 'enthusiasm effect' suggested by Neale (1964), supply and demand are really interdependent. (Dobson and Goddard, 2001).

In addition to gate receipts on match days, catering operations often provide significant revenue. The services offered vary from bars and simple snacks to corporate hospitality. On non-match days most clubs offer facilities for functions and conferences. Clubs are also able to exploit their popularity via merchandising. As well as the traditional souvenirs (e.g. books, badges, scarves, etc.) clubs are capitalizing on the strong video and DVD retail market and the current boom in leisurewear goods. In addition to replica kits, there usually is a number of different items of clothing. (Szymanski and Kuypers, 1999)

The clubs are attractive to advertisers and sell advertising space on perimeter boards, programs, tickets, Internet home pages etc. Sponsorship of the club, the stadium, and the kit is also common. For example, at Manchester United, the club sponsors are Vodafone and the kit sponsors/providers are Nike. Club sponsors usually have their name on club kits as well as a significant profile inside the ground. Some club sponsorship has also included the stadium, for example Bolton Wanderers' stadium is known as the Reebok Stadium. Other less significant revenue sources include the Football Trust (a national organization which receives funding from levies placed on a popular football betting scheme known as 'football pools' and distributes this to clubs for ground improvements, safety projects, and policing) and issuing bonds or equities on the stock market as a means of raising finance.

As well as earning income directly clubs also receive money from their league/association. The two major sources of revenue for the league/association are sponsorship (currently the Premier League is sponsored by Barclays Bank plc, the Football Association by e.g. Nationwide) and television revenue. The Premier League sells the television rights to the competition as a package and distributes the majority of the income between clubs. This is also true for the FA Cup, League Cup, and UEFA Champions' League. Broadcasting is of increasing importance to sport. Televising events brings revenues far beyond what could ever be gained from match attendance. Broadcasting also provides the leverage for further revenues from sponsorship, advertising, and merchandising. In football, the sums have become enormous with the appearance of satellite television. In 1978, the BBC signed a four-year contract with the Football League for a £9.8 million whilst the four-year BSkyB deal for 1997-2001 is £670 million. (Cameron, 1997) For example, the annual rights fee for English First Division football in 1983 was £2.6 million (Bainbridge, Cameron, and Dawson, 1996). Twenty years on it, for the time period of 2001-2004, the annual rights fee had grown to €673 million (Morrow, 2003, 14) or approximately £440 million. In particular, competition from satellite broadcasting upset the pre-existing terrestrial 'duopsony', and brought about a tenfold increase in broadcast revenues.

The presence of broadcasting accentuates certain features of team-sports economics. If the fee structure correlates with team popularity and success then this will strengthen the dominance of certain clubs. In Premier League football, broadcast revenues have been distributed as a three-part payment consisting of a flat share-out plus a match fee plus a 'merit' fee based on league position. This will give an extra push to the upward pressure of the fees for star players. The potential loss of lowly teams through bankruptcy, and their role as talent nurseries, will increase as the possibility for viewing matches at home may displace attendance at lower status games. (Cameron, 1997)

2.1.3 The labor and transfer markets

While the earnings of some superstar players are now a cause of controversy, above-inflation increases in players' wages, especially at the highest level, have been a permanent feature of English football since the abolition of the maximum wage in the early 1960s. Scarcity of supply of the highest talent, together with the very large audience reach of the top performers, are important factors which help to explain highly skewed earnings distributions. Wage structures are often very hierarchical, and players who are perhaps only a small fraction better than others frequently earn several times as much. Dawson et al. (2000) state that appearance payments and bonuses based on match outcomes, league position, and cup success are a significant component of total player wages. Dobson and Goddard (2001) propose the rank-order tournament model as one plausible explanation for observed wage differentials, where the massive salaries of the top players are regarded as equivalent to generous first prize in a tournament, encouraging all players to contribute maximum effort to the team's cause in an attempt to become the next prize winner.

To keep the wages and transfer fees from raising too high and, eventually, from leading to the unequal distribution of talent and income and decreased competitive balance, several options have been explored in real life and in empirical research, among them salary caps, the maximum wage, the reserve clause, and the retain-and-transfer system.

Kowalewski and Leeds (1999) study the impact of the salary cap and free agency on the structure and distribution of salaries in the National Football League and find that free agency, coupled with two different salary caps, has created distinct winners and losers. The findings are similar to those obtained by Quirk and Fort (1992): salaries have become less equally distributed. Superstars have gained dramatically from the free agency. However, the pay of the bottom two-thirds of the income distribution has fallen. In particular, the pay of mid-level players has declined dramatically.

Rottenberg (1956) is widely credited with writing the first academic analysis of the economics of professional team sports. At the time of his study, the US professional baseball players' contracts included a reserve clause limiting players' freedom of movement by binding them to their present employers. The clause was defended by the baseball authorities on the grounds that it was necessary to ensure an equal distribution of playing talent among teams to maintain uncertainty of outcome and spectator interest in the league competition as a whole, and not to depress the attendances and revenues of all teams. Rottenberg (1956) finds that the reserve clause does not achieve its stated aim of influencing the allocation of playing talent between teams. Moreover, he argues that free agency in the players' labor market would not necessarily lead to a concentration of the best players in the richest teams. The main effect of the reserve clause is that players receive salaries below their value to the team that employs them.

The retain-and-transfer system and the maximum wage were both key features of English football's labor market from the beginning of professionalism. Both were designed to prevent the clubs with the most resources from acquiring all the most talented players by outbidding other clubs for their services. The retain-and transfer originated in an FA regulation, requiring clubs to register their players annually with the FA (Dobson and Goddard, 2001). Player registrations immediately became tradable commodities between clubs, since unregistered players were not permitted to appear (Morrow, 1999). All player contracts were renewable annually at the club's discretion, and clubs were entitled to retain a player's registration even if his contract was not being renewed. A player could move only if his present club was prepared to release his registration or to sell it in returns for a transfer fee (Steward, 1986). The maximum wage was abolished in 1961, and the retain-and-transfer system was substantially revamped in 1963 and in 1978 with the introduction of the 'freedom of contract' system, which awarded players the right to decide themselves whether to move on the expiry of their contracts.

During the last decade, the relaxation of a number of regulations which previously restricted mobility in the players' transfer market, especially at international level, has been significant. The 'three players rule' which prevented clubs from fielding more than three overseas players at any one time has been abolished. Also, the landmark 1995 European Court of Justice ruling in the Jean-Marc Bosman case, which prevents a club holding the registration of an out-of contract player from receiving a fee if the player moves to another club in a different EU country, has created greater flexibility in the football labor market. Dobson and Goddard (1998) argue that these changes make it easier for the clubs with the most resources to secure the best players simply by paying them more than the rest can afford. Simmons (1997) assesses the implications of Bosman case for the operation of football transfer markets. Although many more out-of-contract footballers are able to move between clubs without payment of transfer fees to the selling club, Simmons argues that there remains a role for transfer markets in professional football, with compensation to selling clubs for training, development, and replacement of players.

There are several empirical studies of transfer fees in English association football (see, for example, Carmichael and Thomas, 1993; Reilly and Will, 1995; Dobson and Gerrard, 1999). All of these studies show that transfer fees are highly systematic, depending on player characteristics including age, league and international experience, and goal scoring record as well as the size and divisional status of the buying and selling clubs.

2.2 Competitive balance and uncertainty of outcome

Sport organizations encage in cooperation contributing to the 'peculiar economics' of sport (Neale, 1964). In order for matches to occur, there must be scheduling, rules, officiating, an appeals process, and a championship structure. Sport organizations facilitate the production of team sports in the first place (Fort, 2000). Sporting contests and tournaments are joint products, the attractiveness of which depends in part on uncertainty of outcome. If a contest becomes a foregone conclusion, fans lose interest and gate attendances fall. Gerrard (1999) calls the phenomenon the 'New York Yankees paradox' – after several years of dominating major league baseball, the Yankees' home gate receipts started to decline and only recovered when the team became less successful. The need to maintain competitive balance means that, unlike in other industries, there is nothing to be gained from driving competitors out of business. Monopolization reduces profits in professional team sports. Thus, sporting competitors encage in various forms of economic collusion to ensure competitive balance.

All professional sports leagues face the same problem of how to maintain competitive balance between teams with very different capabilities to generate revenues. Szymanski (2001) asserts that increasing income inequality tends to reduce competitive balance and competitive imbalance tends to reduce fan interest. Big-city teams with bigger fan bass, such as Manchester United and Chelsea FC, are more able to generate revenues and, hence, are more able to pay the highest wages needed to attract best players. The dynamics of team competition will force teams to acquire the best possible players and inevitably, the teams with the bigger resources will dominate, creating dynasties and perpetual league-bottom teams. If the leagues become predictable, fans lose interest and all teams lose financially. Thus professional sports leagues have had to develop regulatory mechanisms to maintain a degree of competitive balance through the equalization of playing strengths while ensuring sufficient incentives for all teams to compete effectively. (Gerrard, 1999)

Literature about income distribution, competitive balance and the attractiveness of sports has been mainly concerned with the proposition that income redistribution will lead to greater equality of outcomes. Most professional sports leagues have sought to maintain competitive balance through some form of player reservation system under which teams are granted exclusive rights to acquire and retain their players. Examples of these systems are the reserve clause in major league baseball and the retain-and-transfer system in association football.

Several North American sports have also used a drafting system, with the rights to draft new players being determined by part performance; poorly performing teams are given preferential treatment in the recruitment of new playing talent. The success of the player reservation systems remains controversial. Rottenberg (1956) states that the player reservation systems have no effect on the final distribution of talent across teams. By restricting the bargaining rights of players, team owners are able to use their monopsonistic power to restrict player wages.

Aside from player reservation systems, professional sports leagues have also attempted to maintain competitive balance through various revenue-sharing agreements. Historically many sport leagues have split gate receipts equally between the home and away teams. The collective selling of broadcasting rights has become an increasingly important mechanism for cross-subsidization between teams. TV contracts have tended to be negotiated by leagues, rather than individual teams, with teams agreeing a formula for the distribution of TV revenues between each other (Gerrard, 1999).

Player reservation systems, sharing of gate receipts, and collective selling of broadcasting rights are self-regulatory mechanisms that professional sports leagues have used to maintain competitive balance. But in recent years, these regulatory mechanisms have been often ruled as restrictive practices. Player reservation system has been deemed to restrain trading. As a result, there has been a progressive move to free agency for players with expiring contracts. The move towards free agency has allowed players to move between teams more easily. This has led to high growth in player wages. Free agency threatens the competitive balance of leagues as well as their financial viability (Anderson and Siegfried, 1997; Simmons, 1997). The high-revenue teams can outbid the low-revenue teams for the best playing talent, leading to a concentration of the star players in the biggest clubs. Wage inflation has tended to become generalized so that the smaller teams get locked into a vicious circle of decline as costs rise faster than revenues, forcing teams to economize on playing talent with further adverse effects on gate attendances and associated revenue streams. There has also been a trend in Europe for sports leagues to have to defend their collective arrangements for selling broadcasting rights before the competition authorities (Gerrard, 1999). However, as in the litigation cases of the collective selling of broadcasting rights in Spain and in Holland, in the Premier League broadcasting case heard in the UK Restrictive Practices Court in 1999, the court decided that selling broadcast right collectively (and preventing clubs from selling any broadcast rights individually) was in the public interest, in part because the collective sale promoted financial equality, which in turn promoted competitive balance/uncertainty of outcome (Szymanski, 2001).

Following Rottenberg (1956), a number of US economists have developed theoretical models of competitive balance in sports league competition, which formalize some of Rottenberg's original insights, and permit exploration of number of other policy issues. Quick and Fort (1992) and Vrooman (1995) investigate whether income redistribution will lead to greater equality of outcomes and conclude that competitive balance would be unaffected by redistributive mechanisms such as gate sharing, i.e. a visiting team receives a fixed percentage of the home team gate. However, Szymanski (1998b) argues that gate sharing may even have the perverse effect of reducing competitive balance by leading the small teams to reduce investment in talent by more than the big teams, as under gate sharing they gain more from the success of big teams. Fort and Quirk (1995) review the cross-subsidization devices that have been adopted by sports leagues – league treatment of inputs, revenue distribution among teams and rules covering franchise relocation and league expansion – and come to the conclusion that salary cap is the only effective cross-subsidization device currently in use in professional team sports. Késenne (2000) shows that a salary cap can improve the competitive balance among clubs as well as the salary distribution among players. However, the applicability of these devices to European football may be limited and met with resistance from clubs and stakeholders, such as players.

Carmichael and Thomas (2000) study team performance in the English Premiership football and confirm an emergence of a group of elite clubs who dominate the other clubs in the league, with the remainder being more competitively balanced. Szymanski (2001) examines rapport between financial inequality, competitive balance and attendance at English professional league soccer. He maintains that while financial inequality among the clubs has increased, competitive balance has remained relatively stable and match attendance appears to be unrelated to competitive balance. A clearer test of this link is suggested by comparison with FA Cup matches. Because income inequality is primarily driven by inter- rather than intra-divisional inequality, the FA cup has been a much more unbalanced competition than the divisional championships. Attendance at FA Cup matches for same division teams relative to corresponding league matches has fallen over the last twenty years. Szymanski (2001) also shows that increasing competitive balance is not always desirable. Fan interest depends on several factors, and while competitive balance is one, an equally important consideration is the success of the team the fan supports. If fan support is unequally distributed between teams then a utilitarian welfare function is likely to suggest that imbalance in favor of more strongly supported teams is optimal.

Fort (2000) concludes that the team location function of leagues and national associations leads to competitive imbalance and a variety of mechanisms are typically proposed to alter that outcome. Some will not alter the competitive balance (gate revenue sharing) while some can (salary caps) but may fail due to cost of enforcement. Others can insure the survival of small revenue market teams (general revenue sharing as a straight forward cross-subsidy) and some have better outcomes for teams relative to players (drafts, salary caps, and the maintenance of transfer fees). But fixing competitive balance does not require joint venture approaches or alterations in the labor markets. Those can only redistribute sport revenues in favor of teams over players.

Sports leagues are necessarily a collective good. It takes two teams to produce a sporting contest and many teams to produce a league or cup tournament. Unlike other industries, the professional team sports industry can only exist if independent business units engage in extensive cooperation. Sports leagues are joint ventures, not cartels. As a collective, teams must ensure competitive balance. This requires some form of regulatory mechanism to reconcile the individual self-interest of teams to maximize their playing strengths with the collective good of achieving a degree of parity in playing strengths across teams. The enforcement of free-market rules on an industry that, by its very nature, must operate collectively threatens to destroy professional team sports. (Gerrard, 1999)

2.3 Team performance

Rottenberg's (1956) and Neale's (1964) studies on the economics of US professional sports assume that sports clubs are profit maximizers. Sloane (1971) suggests that rather than maximizing profits football clubs maximize utility, subject to a financial solvency constraint. Probably the most important objective in the utility function is playing success. This subchapter discusses team performance, how it is measured in football studies, and its relation with revenue and profits.

2.3.1 Measuring team performance in association football

The use of winning percentages as a measure in association football is problematic since it excludes drawn outcomes which are considered to constitute a positive outcome and for which teams are awarded league points. In some circumstances a drawn match in an away fixture against a strong rival may be considered as important for league success as a home win against weaker opposition. (Dawson et al., 2000)

Another difficulty in measuring team performance is the complex structure of playing season in many team sports with teams competing in several league (i.e. round-robin) and domestic and international cup (i.e. knock-out) competitions. Many studies of team performance have tended to focus exclusively on performance in the domestic league competition (for example, Szymanski and Smith, 1997; Audas, Dobson, and Goddard, 1997; Carmichael and Thomas, 2000).

Dawson et al. (2000) focus on team performance in the domestic league only and use the winning percentage (defined as the number of games won as a proportion of the total number of games played, drawn matches are given zero weighting), the winning percentage including drawn matches as 'half-wins' (i.e. drawn match equals 0.5 for a win), and the number of league points gained as a proportion of the maximum possible as the measures of team performance.

In Europe domestic leagues and divisions are usually organized on a hierarchical basis with teams allocated to divisions on the basis of merit through a promotion and relegation system. League schedules are determined on a divisional basis with teams playing a complete set of round-robin matches against all other teams in their division with equal numbers of home and away matches. The hierarchical structure of many European domestic leagues implies that team performance can also be measured by league placing both within individual divisions and across divisions and leagues. Currently there are 92 teams in the FA Premier League and the three divisions of the Football League. It is, thus, possible to measure team performance by ranking teams from 1 to 92 on the basis of their end-of-season league placing, with top place in the Premiership ranked first and the bottom place in Division Three of the Football League (called Football League Two) ranked last. This is the approach adopted by Szymanski and Smith (1997) and Szymanski and Kuypers (1999) who use a log transformation of league ranking, -Ln [League Ranking/ (93-League Ranking)]. (Dawson et al., 2000)

2.3.2 Team performance and revenues

Indicators of fan interest such as team revenues and home attendance consistently exhibit a positive and significant association with team performance. Rottenberg (1956, 246) hints at the importance of winning championships in writing, "Attendance at the games of any given team is a positive function of the average rank standing of the team during the season in the competition of its league". Simmons (1996) analyzes the demand for English league football and finds that league position, goals scored, and promotion and relegation between the divisions are all important determinants of attendance patterns.

Both Scully (1974) and Medoff (1976) find a team's revenues to be positively associated with its winning percentage. Winning can lead to better game attendance and, therefore, more revenue. For most football clubs, this effect is limited, as most of their home games are sold out. However, winning teams should be able to increase ticket prices more than losing teams, ceteris paribus. Continued fan interest might contribute to the construction of a new stadium, which might increase ticket sales revenue by adding capacity. Winning can also increase the leasing of luxury boxes and enable to sell lucrative multiyear leases for companies. Advertising and licensing revenue is likely to increase for a winning team, also selling broadcasting rights with better terms. Teams' revenue from advertising and merchandising is indirectly a function of how well they play.

Champions League is a large and variable source of revenue that depends on winning games. During season 2001/02 the starting fee for a club was 3 million Swiss francs (CHF). Match fee for group stage 1 was CHF 0.5 million per match and performance bonus of CHF 0.5 million was given to a club for a win and CHF 0.25 million for a draw. Also, a team finishing last in the group stage still gets an extra CHF 0.5 million. Furthermore, there is also a large market pool from which money is distributed to clubs according to the proportional value of each domestic television market and the number of teams from that market in the competition (Morrow, 2003, 23-24). So, a club making it to the Champions' League, even if only to lose all the games, gains more than CHF 6.5 million. Furthermore, the Champions League makes it possible to draw more ticket revenue and also, as the teams get a considerable amount of visibility by playing in the League, the fan base internationally increases and enables to sell more merchandising and attract better advertising deals.

Aside from the more direct impact on cash flows, winning can have an impact on the value of the franchise through the value of its reputation. Many studies have found that corporate conduct, for example, has a significant impact on the value of firms (e.g., Barber and Darrough, 1996). By winning, the club could add to or maintain the 'goodwill' or franchise value, and losing could detract from the value built over the years before their public offering. (Brown and Hartzell, 2001)

Brown and Hartzell (2001) look for relations between team performance and estimated franchise values, and net income using panel data from teams of the National Football League, Major League Baseball, and the NBA. The relation between the two prior seasons' winning percentages and franchise value is positive and significant. The similar relation for the Boston Celtics alone is tested, and the evidence is consistent with a positive relation between winning and cash flows. These results suggest that successful (in terms of wins) sports franchises – both in general and the Celtics specifically – are profitable. Furthermore, winning increases franchise value.

Fort and Rosenman (1999) study streak management in baseball. They state that team winning and losing streaks are random occurrences, but that winning streaks increase attendance while losing streaks negatively impact the gate for baseball teams. Demmert (1973), Noll (1974), and Hunt and Lewis (1976) find that attendance is related to recent championship winnings and negatively related to games-behind-leader. Demmert states that fan expectations concerning team performance play a major role in the ticket demand function. It is assumed that over the course of a season fans form adaptive expectations concerning their team's probabilities of winning individual games and season championships. Ticket demand at any point in time depends on the prevailing expectations of fans.

Many studies about performance and revenue have implicitly presumed that the direction of the causality runs from performance to attendance, i.e. a successful team will attract more spectators, but not the other way round, i.e. a team with large attendances has the resources to attract better players and thereby generate better performance (Audas et al., 1997). Dobson and Goddard (1998) investigate the relation between performance and revenue in professional league football. They find more evidence of causality running from lagged revenue to current performance than of causality in the opposite direction, while the dependence of performance on revenue seems to be greater for the smaller clubs than for the larger; i.e. the clubs which draw the largest attendances and charge the highest admission prices are also those whose future success depends least on their current gate revenues. Dobson and Goddard also find that the major clubs from the largest cities have enjoyed a large increase in their percentage share of revenue which is not explained by a corresponding improvement in performance. These results support the view that, unless checked by mechanisms for revenue redistribution within the league, the natural tendency is for success to become concentrated increasingly among a small group of elite, wealthy clubs.

2.3.3 Team performance and profit

Manchester United has been financially profitable while winning. It seems that financial success and success on the pitch are related. Between 1992 and 1997 the club generated income of £249 million, of which £69 million was spent on wages and £66 million reported as a profit. Therefore, it could be said that broadcaster BSkyB's offer of £624 million to buy the club in September 1998 can be justified on financial performance alone, rather than any particular interest in the broadcasting rights. However, according to Szymanski (1998a), the reasons behind the success of Manchester United do not characterize football generally. Throughout most of the history of football, profit making clubs have been very much the exception and not the rule. In their investigation of market structure of the English Football League (pre-Premiership), Szymanski and Smith (1997) conclude that there is a high degree of concentration with only a handful of top clubs making profits.

There appears to be no systematic relation between profits and league performance. Szymanski (1998a) demonstrates this by comparing the change in profits in the current year with the change in league performance in the previous year. He states two general principles based on the research: better league performance leads to higher revenue and increased wage expenditure leads to better league performance. As club performance improves, revenues grow as a result of increased attendance, higher ticket prices, increased sponsorships, merchandising, and TV income. As to wage expenditure, better players win more matches. There is a well-developed market for players, which ensures that better-quality players can attract higher wages. As a result, higher wage expenditure improves performance. Szymanski and Smith (1997) and Szymanski and Kuypers (1999) find impressively high correlations between average league position and average wage expenditure.

Szymanski (1998a) states that the reason that these two relationships are so reliable is that, in the absence of significant redistribution of income, which happens in baseball, American football or basketball, football is a highly competitive market. The clubs compete intensively against each other to attract supporters and to obtain the best players. As there is very little of redistribution of income to balance the competition, bigger clubs may be valued more highly in the stock market, but even successful clubs have to plough back the profits into the team in order to preserve the competitiveness of the club.

Also, Szymanski and Kuypers (1999) demonstrate that there is no systematic relationship between profit and performance based on 760 cases where the change in profit from one year to the next is compared with the change in league position. The result is that it appears as likely that when league performance improves, profits will fall as that they will rise, while when league performance deteriorates, it is quite equally likely that profits will fall or rise.

Why is Manchester United successful on pitch and financially?

One of the reasons for the success of Manchester United is that despite not winning a League title or European competition over a dry period from 1972-1990, Manchester United remained a much better supported club than any other, including Liverpool, for which this period was very successful in terms of trophies – 11 League titles, 3 FA Cups, 4 European Cup wins and a UEFA Cup win, plus numerous runner-up positions. For Manchester United, this support was critical to the long-term survival and prominence. In Manchester United's case it seems that the continued support is a consequence of its 'brand image', something which most of its rivals have not been able to replicate. Brands can lose their value if their image fades, and arguably Manchester United's image was beginning to tarnish by the early 1990's. However, getting back to winning caused the image to improve again. (Szymanski, 1998a)

2.4 The contribution of football manager

The contribution of the manager to the performance of organizations is a topic which has consumed much debate among economists and organizational theorists. In few if any other types of organization does the individual manager command such a high public profile as in certain professional team sports. Furthermore, the availability of detailed, comprehensive records of match results that provide an uncontroversial measure of organizational performance makes empirical research on the managerial contribution more feasible than with most other private or public-sector organizations. For these reasons, a number of researchers have looked at managerial effects in professional sports, mainly in the USA.

The direct efficiency effect of managers relates the ability of managers to combine the available playing talent through team selection and choice of tactics to produce match results. Managers also have an important indirect (or leadership) effect on team performance through their ability to recruit, train, and motivate individual players to achieve higher levels of playing performance. (Dawson et al., 2000)

Kahn (1993) studies managerial quality, team success, and individual player performance in Major League Baseball. He investigates the impact of managerial quality on team winning and individual player performance and finds that when player inputs are controlled for, higher-quality managers lead to higher winning percentages. Players tend to play better, relative to their prior performance levels, the higher the manager's quality is. He states that the quality of management makes an important difference in the performance of organizations.

2.4.1 The role of the football manager

Robbins (1994) defines four principal managerial functions – planning, organizing, leading and controlling. Audas, Dobson, and Goddard (1997) use this framework to define the role of the football manager. The planning function involves formulating the organizational objectives (for example winning promotion, improving attendance), establishing a broad strategy to achieve these objectives (for instance, acquiring a player on transfer, focusing on youth policy), and then developing a hierarchy of plans to coordinate these activities. In many clubs the chairman and board of directors are likely to play a major role in formulating broad objectives, although they may grant the manager autonomy over other aspects of the planning function.

The organizational function assigns responsibilities for tasks, including on- and off-field duties. In most clubs, responsibility for coaching, youth development, and scouting is delegated to assistants who can devote adequate time to these tasks. Some clubs, following a model common elsewhere in Europe, have divided responsibility for operational matters (such as first-team selection and tactics) from the more strategic aspects (such as buying and selling players and negotiating contracts) between more than one individual.

In the leading function, the manager is responsible for directing and co-coordinating the people beneath him in the organization. The power to motivate is very frequently cited as one of the most important attributes of successful managers. The situational context is important, since the frequency with which managers leave one job only to be rehired into a comparable position elsewhere suggests that a manager's failure to motivate effectively one group of players does not necessarily imply an inability to lead others under different circumstances.

Finally, as a controller the manager takes responsibility for assessing how effectively the organization is meeting the objectives established. This also involves judging how successfully particular individuals are fulfilling the roles to which they have been assigned (for instance, a striker is missing too many opportunities, the defense is leaking too many goals), and taking remedial action when required. Managers are also responsible for enforcing discipline on matters such as dress and acceptable styles of leisure activity imposed upon players at most clubs. A manager's ability to respond to situations in which individuals or the organization as a whole are not meeting expectations may be crucial for his survival in post. (ibid., 1997)

2.5. Managerial change and team performance

In professional football in the UK and elsewhere, one of the most widely remarked characteristics of the manager's job is its chronic insecurity. In 1977, the West Bromwich Albion manager Johnny Giles observed famously that "the only certain thing for managers is the sack", while in 1997, a BBC television documentary on the role of the football manager was entitled jokingly '*The Sack Race*'. In few, if any, other types of organization is one individual held so directly, visibly, and publicly accountable for collective successes and failures on a weekly, or even daily basis (Audas, Dobson, and Goddard, 1999).

During the 25-year period between August 1972 and August 1997, there were 918 managerial terminations and appointments, representing an average of 36.7 changes per year or one change per club roughly every 2.5 years. English football's rate of managerial turnover is higher than that reported by Scully (1994) for US baseball and basketball, where the mean duration of managerial spells is around three years, and for American football where the mean duration is 4.2 years. (ibid., 1999)

Scully (1995) finds a significant relationship between coaching efficiency and tenure in basketball, baseball, and American football. In addition, Scully finds a significant relationship between a team's standing and the probability of a coach being retained or fired for most major-league baseball and basketball teams. Dawson et al. (2000) investigate coaching efficiency in English association football and find that the estimates of coaching efficiency are only partially correlated with team performance, which they see emphasizing the importance of measuring coaching performance in terms of success achieved relative to the available playing talent rather than purely on match outcomes. Hiring and firing decisions guided only by a coach's winning percentage are unlikely to be optimal and would benefit from the additional source of information provided by estimates of the coach's efficiency.

Fizel and D'Itri (1997) investigate the extent to which voluntary and involuntary managerial succession in US basketball is influenced by the season's win ratio, a prior measure of the team's playing talent (to proxy for success in recruitment), a set of managerial efficiency scores, and a measure of the manager's past experience. In estimations that omit the win ratio, playing talent and manager efficiency are both negatively related to the probability of involuntary termination. These effects disappear, however, when the win ratio is added, indicating that "managerial productivity is overwhelmed in favor of 'did we win?'" (Fizel and D'Itri, 1997, 302)

Audas, Dobson, and Goddard (1997) study team performance and managerial change in the English Football League. They find a relation between team performance and managerial change: poor recent form drives managerial termination especially if it occurs early in a manager's spell. In other words, a manager who has been in post for some time is more likely to be able to withstand a poor run than one currently at a short duration. Managerial turnover is more rapid in the lower divisions, even though managers in clubs in the upper divisions face more intense public scrutiny. Also, there is a distinct seasonal pattern to managerial changes, with peaks in October, January, and April. They also investigate whether managerial change improves team performance in the short-term. Significantly, managerial change appears to have a harmful effect on team performance immediately following a managerial termination. There is a natural tendency for results to improve on average after a poor run of results, simply because no team carries on losing forever. Teams which change managers as a result of a poor spell do appear to benefit from this effect. However, the same teams tend to recover less quickly than teams with a similar pattern of results leading up to some identifiable point of time at which they did not make a managerial change.

Audas, Dobson, and Goddard (1999) examine organizational performance and voluntary and involuntary managerial turnover in English football and the extent to which a change of manager tends to be a consequence of substandard organizational performance. They find that short-term fluctuations in performance strongly influence the involuntary termination hazard, which is also dependent on the team's current league position relative to its position when the manager took charge, and on the win ratio over the entire spell. Managerial human capital attributes are found to have a greater influence on the voluntary rather than on the involuntary termination hazard. Surprisingly, in view of the importance of cup competition in English football, Audas et al. do not find statistical evidence that a team's participation in, or elimination from, the FA Cup competition impacts upon its manager's job security.

2.6 Stock market and ownership in football business

In the beginning of professional football in England in the 1880s, football clubs were voluntary organizations, administered by committees elected by voting members. As the revenues grew with increased gate receipts, many clubs acquired a limited liability status. The first private company in football was formed 1888 and by 1921, all but two of the leagues 86 member clubs had followed suit. From then until recently, professional football's commercial and financial management remained much the same. (Dobson and Goddard, 2001)

Traditionally, major shareholders and the majority of directors of football clubs were from the local business community. Working-class shareholdings were usually too small to influence the running of the club (Russell, 1997). Chairmen and directors with a controlling interest in football clubs are usually individuals who achieved success in business in other fields. Their motives for investing may include a desire for power or prestige, or simple sporting enthusiasm: a wish to see the local club succeed on pitch. (Dobson and Goddard, 2001)

Morrow (1999) identifies a number of characteristics of the financial structure of the typical English football club prior to recent changes in the financing of football. Traditionally, clubs were small, privately owned companies, which tended to be under-capitalized, and to raise little or no finance from retained profit. Under-capitalization (in other words, a relative low ratio of equity to total financing) seems to have been a consequence of the reluctance of many club owners to dilute their personal control by using new equity issues as a means of raising finance. However, many club owners or major shareholders provided significant additional long-term finance as personal loans. Borrowing from banks was (and in many cases still is) another major source of finance for clubs.

2.6.1 Football clubs and listing on the stock market

In most European countries, football clubs have obtained listings in national stock exchanges. The first listing (Tottenham Hotspur) dates backs to 1983. For a number of years Tottenham remained the only club with a Stock Exchange quotation, perhaps because the company's subsequent performance did not encourage to others contemplating on the same move, trading below the opening price of the flotation. However, Millwall carried out a flotation in 1989 and Manchester United in 1991. Again, the early experiences of the quoted clubs were not encouraging, as their shares were trading clearly under their original values. At the beginning of the 1990s, other clubs were experimenting with alternative methods or raising external methods, such as bonds, with varying degrees of success (Dobson and Goddard, 2001).

During the late 1980s and early 1990s, most financial professionals were suspicious of business practices at English football clubs and had strong doubts whether teams could ever be rated on normal investment criteria or be genuine stock market businesses. Such inherent suspicion of the sport meant that the few flotations that were organized received a cool reception. Moreover, investor skepticism deterred other football clubs from moving to the stock market for a considerable period of time thereafter. However, during the mid-1990s, the financial community's pessimism towards football as an industry largely dissipated. Growing crowds, higher ticket prices, brisk merchandise sales, generous sponsorship deals, and especially the lucrative new television contracts between BSkyB and Premier League meant that revenues increased substantially for many football teams in the first half of the 1990s. The re-evaluation of football by the investors meant that for clubs that were determining whether to carry out an IPO, investor sentiment was unlikely to be obstacle (Cheffins, 1999).

Clubs have been restructured to get around league restrictions on running football clubs for financial profit. The football clubs are owned by their respective plc, to which all surpluses are remitted. The shareholders in these financial clubs are mainly financial institutions, although several of the clubs remain largely privately owned, with the directors retaining majority shareholdings after flotation. Individual fans do hold shares in their teams, but even collectively they are a small minority with no effective direct control over the board of directors. As well as being owned by financial institutions, another key development is the increasing ownership of teams by media groups. As the market for broadcasting rights has become more competitive, some media corporations have sought to ensure their access to sports broadcasting rights by acquiring control of the teams. (Gerrard, 1999)

As the level of (financial) competition in football has been increasing steadily, clubs have been issuing shares for a number of reasons. For example, issuing shares generates an inflow of cash needed to buy players and trainers, to build or upgrade facilities, and set up and expand to new activities such as merchandising, leisure and hotel business, and youth training programs. In addition, it offers owners the possibility of capitalizing on initial investments (Cheffins, 1999; de Ruyter and Wetzels, 2000). Finally, as stock listings are continuous performance measures, it has been assumed that this would be a stimulus for better results, both on and off the field, as stock price is a leading indicator of market expectations and discounted future cash flows (de Ruyter and Wetzels, 2000).

McMaster (1997) studies agency problems in professional football and states that if supporters possess more property rights in their respective clubs, efficiency in the financial performance may be enhanced. However, Cheffins (1999) lists factors that may deter listings to the stock market, such as league policy, disclosure obligations, cost, and reduced flexibility. As an example of league policy, in Germany, rules requiring a club to operate as a sports association rather than as a full-fledged company deterred teams from pursuing plans to join the stock market. Lobbying by larger clubs prompted the German football association to relax the relevant regulations in 1998. Also, developments in Britain illustrate that the loss of autonomy associated with a move to the stock market can have a substantial impact on sports teams that go public.

As stock listings are continuous performance measures, it has been assumed that this would be a stimulus for better results, as stock price is a leading indicator of market expectations and discounted future cash flows. However, the rationale of the efficient market hypothesis has, at least in most cases, proven not to be valid. In most European countries with publicly held football clubs, the results have been mixed at best, resulting in football stock portfolios that are frequently unattractive to investors (Woodford, Baines, and Barn, 1998). Dobson and Goddard (2001) assert that a return to the listing boom conditions of 1996 seems unlikely for the foreseeable future. There appears to be a rapidly widening gap between a small number of successful top clubs and the remaining clubs, leading to markedly different on-field and financial performance records. Several factors may account for major price fluctuations in football shares. On-field performance is difficult to predict. Furthermore, whether clubs acquire television and sponsorship contracts or are able to run a successful merchandising operation will have an impact on the share prices. de Ruyter and Wetzels (2000) argue that for these reasons football clubs deciding to go public may not attract many professional investors who generally take investment decisions on economic deliberations, and thus, clubs may have to depend on the support of members and fans instead.

Cheffins (1999) asserts that fans seeking benefits other than simply wanting to own a piece of the team should refrain from buying shares. Football clubs have refrained from offering merchandise discounts or other 'fan-friendly' perks to shareholders. Fans who buy shares in a stock market team are also unlikely to have any meaningful say in company affairs or team operations. The investment may also undergo radical transformation without the consent of the fans. Finally, the statutes which govern corporations typically permit a 'cash merger', when certain stockholders are compelled to accept cash for their shares in corporation. This technique can be used as a 'going private' transaction that takes place when a corporation sheds its links to public securities market by eliminating all outside shareholders.

Gerrard (1999) states that the commoditization of sport creates fundamental conflict between the fans and team owners. Fans want their team to be successful on the field, but the team owners must be also concerned with the financial viability of the team. Sporting performance and financial viability can be conflicting objectives. Improved team performance requires better players, but the team's revenue streams may not be sufficient to sustain higher wage costs. However, Cheffins (1999) states that fans of publicly quoted sports teams are unlikely to suffer in comparison to those who support privately owned franchises. If a business does not offer a competitive product at an attractive price, it will alienate the buying public, sales will decline, and profits will fall. A corporation's shareholders will therefore suffer, if management neglects the customer. Important victories tend to please the shareholders as well as the supporters since a rise in the share price often follows.

2.6.2.Sports team performance and share price movements

There has been some empirical investigation to quantify the extent to which game-related events, carry implications for the share prices of professional sports clubs floated on the stock exchange. If games are seen to contain information about future cash flows of the firms and if new information about team performance is transmitted and absorbed by the markets rapidly, a direct link between fluctuations in fortunes on the field and variations in share prices and trading activity should be discernible empirically.

Dobson and Goddard (2001) study football team performance and share price movements on a sample of 13 football clubs quoted on the London Stock Exchange (LSE) from a two-year estimation period. They investigate the extent to which major game-related events, such as European qualification and elimination, or domestic promotion and relegation, carry implications for the share prices of football clubs. They find that prices respond rapidly and systematically to game-related events. The results of regular league matches exert a clearly identifiable impact on the share price on the next trading day. They confirm that the unanticipated component of the match result (rather than the result itself) is of prime importance in determining the direction and size of the share price adjustment. As well as regular league match results, sporting outcomes with more substantial financial implications also lead to rapid and sometimes very large share price adjustments. These include, in ascending order of importance, elimination from the FA Cup, elimination from European competition, and end-of-season promotion or relegation outcomes. Finally, the extreme sensitivity of football clubs' share prices to major news concerning the 1998 BSkyB takeover bid for Manchester United provides further evidence of the symbiotic nature of the relationship between the football and broadcasting sectors.

Brown and Hartzell (2001) study the publicly traded Boston Celtics of National Basketball Association (NBA) and find that the results of the Celtics' basketball games significantly alter the firm's share returns, trading volume, and volatility. They control for the expected value of the signals by using betting market point spreads, which they find having little effect on the relations. The response of the stock market to wins and losses is asymmetric – losses are penalized more than wins are awarded – and playoff games have a larger impact on returns than the regular season matches. Scherr, Abbott, and Thomson (1993) also study the Boston Celtics but find that regular season results do not affect the returns at all. However, their study does not adjust for the market's expectations about the team's performance and addresses only returns, ignoring other variables, such as volume and volatility.

3 PREVIOUS RESEARCH AND LITERATURE

This chapter reviews the most relevant existing financial literature for this thesis. The first part of the chapter discusses the Efficient Market Hypothesis, followed by presentation of empirical research on the betting market efficiency. The third part examines the empirical evidence on the arrival of public information and its impact on returns and trading behavior. The final part of the chapter briefly reviews literature on the managerial change.

3.1 Efficient market hypothesis

The Efficient Market Hypothesis (EMH) has become an increasingly widely accepted concept since interest in it was reborn in the 1950s and 1960s under the title of the 'theory of random walks' in the finance literature and 'rational expectations theory' in the mainstream economics literature (Jensen, 1978). There are three forms of the hypothesis. The following definitions are according to Malkiel (1989). The weak form of the EMH asserts that prices fully reflect the information contained in the historical sequence of prices. Thus, investors cannot make abnormal profits on the basis of an analysis of past price patterns. This form of efficiency is often associated with the 'Random Walk Hypothesis'. The semi-strong form of EMH asserts that current stock prices reflect not only the historical price information but also all publicly available information. The strong form of EMH asserts that all information known to any market participant about a company is fully reflected in the stock price. Thus, not even those with privileged information can make use of it to secure superior investment results.

3.1.1 Weak form market efficiency and the random walk hypothesis

The weak form of EMH has found general acceptance in the financial community along with the popularity of technical analysis. Samuelson (1965) and Mandelbrot (1966) have proved that if the flow of information is unimpeded and if there are no transactions costs, the tomorrow's price change in speculative markets will reflect only tomorrow's 'news' and will be independent of the price change today. However, 'news' by definition is unpredictable and thus the resulting price changes must also be unpredictable and random. Merton (1980) has shown that changes in the variance of a stock's return (price) can be predicted from its variance in the recent past.

3.1.2 Semi-strong form efficiency

The stronger assertion that all publicly available information has already been impounded into current market prices has proved far more controversial among investment professionals, who practice 'fundamental' analysis of publicly available information as a widely accepted mode of security analysis. In general, the empirical evidence suggests that public information is so rapidly impounded into current market prices that fundamental analysis is not likely to be fruitful (Malkiel, 1989).

Various tests have been conducted to ascertain the speed of adjustment of market prices to new information. Fama, Fisher, Jensen, and Roll (1969) examine the effect of stock splits on equity prices. While not providing any economic benefit themselves, splits are usually accompanied or followed by dividend increases that do convey to the market information about management's confidence about the future progress. Thus, while splits usually do result in higher share prices, the market appears to adjust to the announcement fully and immediately. Substantial returns can be earned prior to the split announcement, but there is no evidence of abnormal returns after the public announcement. In cases where dividends were not raised following the split, firms suffered a loss in price, presumably because of the unexpected failure of the firm to increase its dividend. Dodd (1981) finds no evidence of abnormal price changes following the public release of the merger information. Although merger announcements can raise market prices substantially, it appears that the market adjusts fully to the public announcements.

Although the vast majority of studies support the semi-strong version of EMF, there have been some studies that do not. Ball (1978) found that stock-price reactions to earnings announcements are not complete. However, Watts (1978) performed corrections suggested by Ball to reduce the estimation bias and still found abnormal returns. Rendleman, Jones and Latané (1982) also find a relation between unexpected quarterly earnings and excess returns subsequent to the announcement date. Bamber (1986) studies unexpected earnings announcements and trading volume and finds a continuous (positive) relation between trading volume and the magnitude of unexpected earnings. Datta and Dhillon (1993) show that bondholders react positively (negatively) to unexpected earnings increases (decreases). Also, Pearce and Roley (1983) find that stock prices respond only to the unanticipated changes in the money supply, as predicted by the efficient market hypothesis.

3.1.3 The strong form of Efficient Market Hypothesis

As the previous studies indicate, stock splits, earnings, dividend increase, and merger announcements can have substantial effects on the share prices and thus, insider trading on such information can create profits before the announcement date, as documented by Jaffe (1974). While such trading is generally illegal the fact that the market often at least partially anticipates the announcements suggests the possibility of profiting on the basis of privileged information. Thus, the strongest form of the EMH is clearly disproved. Nevertheless, there is considerable evidence that the market comes reasonably close to the strong-form efficiency [see e.g. Cowles (1933), Friend et al. (1962), Jensen (1969)].

In general, the empirical evidence in favor of EMH is strong. However, along with the general support for EMH there has been anomalous evidence inconsistent with the hypothesis in its strongest forms, as reviewed by Jensen (1978) and Ball (1978). For example, Shiller (1981) argues that variations in aggregate stock prices are much too large to be justified by the variation in subsequent dividend payments, which is an apparent rejection of the EMH. However, Marsh and Merton (1983) conclude that Shiller's findings are a result of misspecification rather than a result of market inefficiency, which is supported by Kleidon (1986).

3.2 Betting market efficiency

Bets and betting markets provide a convenient way to examine market efficiency. Tests of the Efficient Market Hypothesis (EMH) often focus on the stock markets or foreign exchange markets and are "hard to interpret since they are joint tests of market efficiency and a particular model of market equilibrium" (Dana and Knetter, 1994, 1317). Like securities markets, betting markets involve public information and numerous participants, including professionals, and offer readily observable market expectations and outcomes (Golec and Tamarkin, 1991).Thus, some researchers (e.g., Dana and Knetter, 1994; Even and Noble, 1992; Lacey, 1990) use the simpler market of wagering on sporting games as a test of the EMH.

Jaffe and Winkler (1976) assert that football betting markets are analogous to securities markets: a gambler 'invests' through a bookmaker (market-maker) at a market-determined point spread (price), which is the market's expectation of the number of point by which the favorite will outscore the underdog. The larger the spread, the larger the handicap the favorite must overcome. Those who bet on the favorite believe their team is underpriced; they speculate that the favorite will defeat the underdog by more than the point spread. In turn, those who bet on the underdog believe that the favorite is overpriced, i.e. that the favorite will either lose the game or win by less than the point spread. Golec and Tamarkin (1991) discuss more in details setting the point spreads.

The use of point spread betting market to make inferences about the operations of traditional markets has become common in the finance literature (see Gandar, Zuber, O'Brien, and Russo, 1988; Golec and Tamarkin, 1991; Brown and Sauer, 1993b; Gray and Gray, 1997; and Gandar, Dare, Brown, and Zuber, 1998). In betting markets, fundamental values in the form of differences in the points scored by the two teams are revealed as games are played; market forecasts of these point differences (prices) are represented by point spread betting lines.

The studies testing betting market efficiency are numerous and the results are diverse. Sauer, Brajer, Ferris, and Marr. (1988) cannot reject the null hypothesis that the betting market is efficient. Dare and MacDonald (1996) find little or no evidence against market efficiency in the National Football League (NFL) and college betting markets for regular season games. They do, however, uncover evidence of biased betting lines for Superbowls. Paul, Weinbach, and Wilson (2004) examine the market for National Basketball Association (NBA) totals[2] from 1995-96 to 2001-02 and come to the conclusion of an efficient market. In addition, betting with or against streaks in the spirit of 'hot hand' are not found profitable.

Woodland and Woodland (1994) and (2001) investigate the odds betting in professional baseball and hockey, respectively, and find that favorites are over bet and underdogs are under bet. Paul and Weinbach (2002) find that bettors over betting the over and under betting the under in professional American football. For football and hockey, the strategy of betting the under or underdog against the total or side is found to violate fair bet and is profitable at the very highest numbers, which is similar to the behaviorist idea that systematic errors occur in investor expectations in financial markets that lead to the misevaluation in prices of securities (Hirshleifer, 2001). For baseball and totals in basketball, violations of a fair bet are found at the highest numbers, but with limited profitability, which is suggestedly due to the size of the basketball market not being large enough for uninformed trades to dominate the informed bettors.

Some professional gamblers recommend betting on underdogs because they believe there is a 'bandwagon' effect of unsophisticated bettors over betting the favorite teams. Evidence from Vergin and Scriabin (1978) using data covering 1969-1974 supports this claim, while Tryfos et al. (1984) and Gandar et al. (1988) show that betting the underdog was unprofitable during 1975-1981 and 1980-1985, respectively. However, Gandar et al. (1988) find that the results of the behavioral technical rules strongly indicate that irrationality characterized the NFL betting market and profit opportunities based on these rules exist.

Some degree of market inefficiency is demonstrated in the studies by Golec and Tamarkin (1991), Lacey (1990), and Amoako-Adu et al. (1985), each testing rules for betting and finding some evidence of profitable strategies over limited time periods. Also, Gray and Gray (1997) demonstrate in the NFL market that betting strategies based on a probit model can generate statistically significant profits. Golec and Tamarkin (1991) study the efficiency in NFL and college football betting market. They find that for the NFL betting market, bets on underdogs or home teams win more often than bets on favorites or visiting teams; however,

[2] Totals are bets on the number of points scored by both teams in a given game. The bets take the form of an over, meaning that the bettor wins if the combined points scored are more than the posted number, and an under, where the bettor wins if the combined points scored are less than the posted number. (Paul et al., 2004)

profitable exploitation of the biases depends on the magnitude of transaction costs. The results for the college betting market show more efficiency than the NFL market, as the NFL betting attracts more unsophisticated bettors than the college betting market, which is dominated by professional gamblers. Also, Zuber, Gandar, and Bowers (1985) find that profitable betting opportunities exist in NFL betting market. This finding indicates that speculative inefficiencies appear to be present in this market. However, Zuber et al. (1985) state that the existence of speculative inefficiencies does not necessarily imply market inefficiency. Sauer et al. (1988) argue that the tests performed by Zuber et al. (1985) are misleading and present a variety of evidence that contradicts the assertion by Zuber et al. that the betting market for NFL is inefficient.

Dobson and Goddard (2001) conduct an investigation of the weak-form efficiency of the odds posted by a leading high-street bookmaker for fixed-offs betting on the outcomes of football league matches and uncover some evidence of inefficiency in the transmission of information. The bookmaker's odds do not make maximum use of all relevant historical data in the public domain, and so fail to satisfy the standard criteria for weak-form efficiency. However, the inefficiencies are insufficient to suggest trading strategies that can overcome the margins and tax deductions built into the bookmaker's prices.

3.2.1 Betting market and informed traders

Brown and Sauer (1993b) use the point spread betting market on NBA games to address the issue of unexplained asset volatility. They demonstrate that game-to-game variations in point spread betting lines reflect fundamental information, and that forecast errors of their model (differences between actual betting lines and their model's forecasts of these lines) are directly and proportionately related to actual game outcomes. Brown and Sauer interpret this as a strong indication that the unexplained game-to-game betting line variations, rather than being noise, represent fundamental information.

Gandar et al. (1998) examine betting line changes from the opening to the closing of the point spread betting market on NBA games for evidence of informed trader betting. They find that in this market traders process information into price. Bettors in this market appear to be able to identify teams whose chances of winning against initial bookmaker lines are undervalued. Furthermore, their betting appears to cause bookmakers to adjust lines sufficiently that by the close of betting these biases are removed. They interpret these results as evidence that informed traders are present and influential in the NBA betting market and that price changes in this market are not simply noise but contain information that causes prices to more accurately reflect fundamental values. Concerning the origin of the informed trading, it appears that public information sources do not explain the informed betting and thus, Gandar et al. come to the conclusion that informed traders either possess private information or are superior to bookmakers in the processing of the information available in this market.

Colquitt, Godwin, and Caudill (2001) examine whether differences in the availability of information across markets result in different efficiencies of price information across those markets. They utilize the National Collegiate Athletic Association (NCAA) basketball betting market to make inferences about financial markets and find that participants in the betting markets of NCAA conferences with greater (lesser) information availability misprice the fundamental values of the conference games to a lesser (greater) degree, which suggests that differences in fundamental information result in different relative pricing efficiencies across those markets.

3.2.2 The hot hand

The possibility exists that bettors are influenced by streaks. This phenomenon is named the 'hot hand' and is examined by Camerer (1989) and Brown and Sauer (1993a). If people believe that players have hot hands within the game, and belief in the hot hand stems from misunderstanding of random sequences in general, then bettors should also believe teams have hot and cold streaks across games (Camerer, 1989). For sides on professional basketball, it is found that winning or losing streaks change both team performance and the lines on the game. Although the idea of how team ability varies on a game-by-game basis is interesting, what matters to the bettor is if following streaks can reveal a profitable strategy. If the betting public believes that recent performances are leading to more or less scoring, but actual scoring performance is unchanged, betting against these streaks should be profitable. If the line adjusts to all new information in the market, none of these strategies should be profitable. (Paul et al., 2004)

Fort and Rosenman (1999) study streak management in baseball. They state that team winning and losing streaks are, by and large, random occurrences. However, there is evidence that some managers may be better than others at extending winning streaks and ending losing streaks (holding win percentages constant), which is referred to as 'streak management'. Camerer (1989) finds evidence that the basketball market believes in the 'hot hand', but that the market's error is too small to be exploited profitably. A profitable rule for (American) football betting, related to the hot hand myth, is to bet against the favorites who beat the spread by a wide margin in the previous week (Gandar et al., 1988).

3.2.3 Home field advantage

There appears to be a home field advantage in sports. In NFL, home teams won 58% of games over the period of 1981-1996 (Vergin and Sosik, 1999, 21). Schwartz and Barsky (1977) propose three explanations for the existence of home team advantage: learning factors (e.g. familiarity with the stadium and its playing surface), travel factors (e.g. visiting teams experience physical and mental fatigue and disruption of routine), and crowd factors (e.g. crowds may provide social support).

Baumeister and Steinhilber (1984) find that professional baseball and basketball teams play unusually badly (choke) in decisive home games of championship series (i.e. home field disadvantage). However, a reanalysis with more recent data by Schlenker et al. (1995, 632) indicates that "the home field is an advantage". They conclude that in several studies, covering amateur and professional baseball, football, basketball, and ice hockey, home teams have been found to win more often than visiting teams, usually anywhere from 53% to 64% of the time.

Vergin and Sosik (1999) conduct an examination of the betting market on NFL games, which shows that bettors generally recognize the magnitude of the home field advantage. The point spreads are, on average, efficient, as home teams beat the spread about half the time. However, the home team field advantage increases with the intensity of interest in a game. Home teams repeatedly react to the emotional intensity in the crowds of important games to a greater extent than the betting public recognizes and the point spreads fail to be efficient for those games. Also other studies find that betting the home team is recommended because unsophisticated gamblers may underestimate the home field advantage. Amoako-Adu, Marmer, and Yagil (1985) find that betting on the underdog playing at home was profitable in their sample covering 1979-1981, suggesting that both types of inefficiency occurred. The results by Golec and Tamarkin (1991) are similar.

3.3 The arrival of information and the reaction of traders

The work of French and Roll (1986), Harris (1986), and others has uncovered empirical regularities in securities price behavior, which has in turn generated substantial interest among financial market theorists. A common feature of the empirical and theoretical research in this area is the central role of information determining price volatility. Volatility can be induced by macroeconomic news, or trading that acts on private information.

A number of market microstructure papers have cast a doubt on the incorporation of information explanation, whether day-to-day and within-day changes in asset prices reflect the incorporation of information into price. For example, studies by French and Roll (1986), Roll (1988), and Cutler, Poterba, and Summers (1989) show that market volatility is much larger over periods when the market is open than over comparable periods when market is closed, and that external news is not responsible for the majority of large daily stock price changes. The implications of this research is either that the arrival of private information causes price volatility or that trading itself introduces noise into prices. The within-day price change study by Amihud and Mendelson (1987) demonstrate that prices formed at the opening of trading are more volatile than prices determined at other times of the day. These authors suggest that trading mechanisms used at the start of trading may be responsible for noisier opening prices. On the other hand, Gerety and Mulherin (1994) using forty years of hourly price index data from the NYSE, find that transitory price volatility declines steadily over the trading day. This price volatility pattern is consistent with the hypothesis that trading aids price formation rather than the alternative arguments that trading mechanisms add to price volatility at the opening or that price changes are simply noise.

French and Roll (1986) study stock return variances and find that asset prices are much more volatile during exchange trading hours than during inactive hours. Three different explanations for this phenomenon are that volatility is caused by: 1. public information, which is more likely to arrive during normal business hours, 2. private information, which affects prices when informed investors trade, and 3. pricing errors that take place during trading. Although a significant part of the daily variance is generated by mispricing, the behavior of returns around exchange holidays indicates that private information is the main factor behind high trading-time variances. The divergence between trading and nontrading variances is caused by differences in the flow of information during trading and nontrading hours. Most of this information is private.

Chang, Jain, and Locke (1995) study the volatility in the Standard & Poor's 500 index futures market and find that the volatility immediately drops significantly after the NYSE closes. This supports the hypothesis that substantial volatility is contemporaneous with trading. Because it seems unlikely that there would be a big difference in the amount of publicly available information released right before the bell versus right after, this can be taken as further evidence that that noise or private information is responsible for substantial volatility.

Brown and Hartzell (2001) find that the increased volatility associated with games occurs largely when the market is open, even though the games occur when the market is closed. They interpret this as new evidence that much of the difference between open- and closed-market volatility can be attributed to traders acting on private information. Volatility and volume are higher during the season as a whole and on days that follow the games. Returns reflect game results, and losses drive the impact on returns during regular season. Playoff games have a significant, incremental impact on returns, but this effect is found for both wins and losses.

Stoll and Whaley (1990) estimate closed-market volatilities using opening stock prices and find that stocks on the New York Stock Exchange tend to be more volatile during the day, particularly so near the market's opening. The conclusion from the study is that at least some component of the higher daytime volatility is due to private information revealed through trading, but most of the difference between closed- and open-market volatility is found to be due to the availability of public information.

Harvey and Huang (1991) examine volatility in the foreign currency markets. While the disclosure of private information through trading may partly explain discovered volatility patterns, they conclude that the increased volatility is more likely driven by macroeconomic news announcements. Ederington and Lee (1993), building on the work of Harvey and Huang (1991), show that scheduled macroeconomic news announcements are responsible for most of the observed time-of-day and day-of-the-week volatility patterns in interest rate and foreign exchange futures markets. After correcting for these public signals, intra-week seasonal patterns in volatility effectively disappear. This can be interpreted supporting the finding of Stoll and Whaley (1990) that higher open-market volatility is mainly due to releases of publicly available information.

Jones, Kaul, and Lipson (1994) examine the effects of trading and information flows on the short-run behavior of stock prices during trading and nontrading periods. The latter is defined as periods when exchanges are open but traders endogenously choose not to trade. They find that a large proportion of daily stock return occurs without trades and provide new evidence that public, rather than private, information is the major source of short-term volatility.

3.4 Management turnover

Managers are generally held responsible for a firm's performance and are likely to be replaced after a firm performs poorly. This subchapter discusses the empirical findings related to the two elements of managerial change that are further investigated in this thesis: first, evidence on the relation between managerial change and prior firm performance is presented, followed by discussion on management turnover and subsequent stock market reaction.

3.4.1 Management turnover and corporate performance

Many studies find that rate of turnover is negatively correlated with firm performance, and that the probability of a change increases when performance falls. McEachern (1977) finds that executives have longer tenure in superior performing firms. Firms are more likely to change their CEOs following four or more years of declining profits. Coughlan and Schmidt (1985) study the relation between the firm's stock price performance and CEO turnover and finds that prior stock performance is inversely related to turnover for those younger than 64 years. Benston (1985) finds that managers are more likely to leave only those conglomerates whose stock returns declined.

Dahya et al. (1998) find a strong relation between poor firm performance and the probability that the top management of these firms will be forced to leave prematurely. Studies by Warner, Watts and Wruck (1988), Lubatkin, Chung, Rogers, and Owers (1989), Canella, Lubatkin and Kapouch (1991), Datta and Guthrie (1994), Denis and Denis (1994), Kaplan

(1994), and Kang and Shivdasani (1995) have all arrived at the view that there is a negative relation between prior share price or accounting profit performance and the probability of a top management change. Contrary evidence is presented in the US studies by Friedman and Singh (1989), Davidson, Worrell and Cheng (1990) and Puffer and Weintrop (1991), all of which fail to document any statistically significant relation between company performance and top management changes. The findings of Warner, Watts and Wruck (1988) and Gilson (1989) suggest that the likelihood of a dismissal increases when firms become financially distressed, but the actual probability of this event occurring is still relatively small. It follows that factors other than company performance – such as the ownership structure of the firm, the composition of the board of directors, the age and tenure of the top executive and the availability of a suitable replacement for the incumbent – are likely to influence the board's decision to reshape the top management team (Dahya et al, 1998).

3.4.2 Stock market reaction to managerial change

The top management team controls corporate resources, and any change in the team should therefore be of great interest to the shareholders (Furtado and Karan, 1990). Hiring and firing of top managers by the board of directors is one of the most important – and possibly beneficial – internal mechanisms of corporate control (Manne, 1965; Alchian and Demsetz, 1972; Fama, 1980). Yet the empirical research gives conflicting results about the possible benefits of such internal control.

Market response to change can be viewed either due to the gain or loss of human capital or as a signal for the change. It is believed that managers possess firm-specific or general human capital (Becker, 1964). When managers with firm-specific human capital leave, or when there are few substitutes for the departing manager, turnover should affect the firm value. The general human capital is costlessly substitutable and occurs when contract costs are zero or when the replacing manager has similar managerial skills. Turnover of managers possessing only general human capital should not affect the firm value. (Furtado and Karan, 1990)

A second aspect to the market's reaction to turnover, according to Furtado and Karan (1990), is the signal received. Top managers are privy to information not publicly available, and thus a change can release signals about the firm's current and future status to the outside world. The multiplicity of the signals, however, presents a problem. Change may signal redirection in firm policy, reorganization of the firm's assets, change in investment opportunities, a departure of key managers from poorly performing firms, or all of the above. It is also possible that change, when expected (for example in retirements), may not convey any information. The signals can be good, bad, or neutral in their effect on firm value.

Bonnier and Bruner (1989) analyze excess returns to shareholders at announcement of a change in senior management of distressed firms and find that excess returns are significantly positive, which is consistent with the internal corporate control hypothesis that management change following poor performance is associated with gains to shareholders. Also, Furtado and Rozeff (1987) and Weisbach (1988) report significantly positive returns at the management-change announcements.

Beatty and Zajac (1985) find an insignificant negative return at management change announcements. Dahya (2000) finds characteristically small and statistically insignificant returns. Warner, Watts, and Wruck (1988) find a significant association between poor stock performance and the frequency of management turnover but find no significant excess returns to shareholders at the announcement of management change for the total sample. They further classify the changes as CEO changes, forced departures, and outsider changes, and find significant positive abnormal returns only for outsider changes. Mahajan and Lummer (1993) also find no significant effects for their total samples and for several subsamples.

Bonnier and Bruner (1989) hypothesize that the inconsistency in the results of the previous studies is due to an information effect associated with the announcement of management change, which is in line with Warner et al. (1988) and Jensen and Warner (1988) that the abnormal return at announcement of a management change is the sum of an information effect and real effect. The information effect can be negative if the change suggests that the firm's performance was worse than the market has realized. The real effect would be positive if the change is in shareholders' interest.

Event studies of shareholder wealth effects around the announcement of turnover provide inconclusive results. Furtado and Karan (1990) state that the contradictory results may be due to differences in the designs of studies, the varying definitions of top management change, and the sample selection processes. Furthermore, the reporting of average price changes may mask differences caused by factors such as whether turnover is voluntary or forced or whether it is board or manager initiated. Similarly, Dahya et al (1998) summarize studies examining share price responses to the announcement a change in the management in large US and UK companies and find that the market's response of the different types of changes in management are generally inconclusive when analyzed in the aggregate; the abnormal return on the day of the news tends to be small and insignificant. However, once the changes are classified according to the post of the executive and according to the circumstances surrounding the changes, a statistically significant market reaction is usually observed.

4 HYPOTHESES

This chapter presents the hypotheses of the study. The first subchapter presents the hypotheses related to game-related analysis. The second subchapter concentrates on the hypothesis on the timeliness of information, after which the hypotheses related to the managerial changes are discussed. Finally, a summary of the hypotheses is presented.

4.1 Game-related hypotheses

This subchapter presents the bulk of the hypotheses of the study, which are related to games. First, the hypotheses testing the relations between operating revenue, profit and team performance are discussed. The second part presents the hypotheses for games and their impact on trading activity, the expected and unexpected game outcome and returns, and the effect of major game-related events, such as cup games, relegation, and promotion.

4.1.1 Operating revenue, operating profit, and team performance

Game results might affect cash flows through gate receipts, advertising and licensing revenue, merchandising, broadcasting contracts, and sponsorship (Szymanski and Kuypers, 1999, 38). Brown and Hartzell (2001) find evidence on the positive relation between winning, value, income, and revenue for American sports franchises and Boston Celtics specifically. Both Scully (1974) and Medoff (1976) find a team's revenues to be positively associated with its winning percentage. Also, Demmert (1973) and Simmons (1996) find a positive relation between team performance and attendance. The use of revenue data offers advantages over attendance. If successful performance generates more demand, clubs may respond either by allowing attendances to increase, or by raising admission prices. Revenue will capture both responses. Also, in any event, it seems likely that revenues from sources such as merchandising, sponsorship and television are closely correlated with gate revenues for most clubs. Thus, I form the first hypothesis concentrating on the relation between revenue and performance as follows:

H_1: Revenue and performance are positively related.

Also, the relation between profit and performance is investigated in this thesis as there are conflicting findings on this topic. While Brown and Hartzell (2001) find a positive and significant relation between operating income and winning percentage for American sports franchises, Szymanski and Kuypers (1999, 24-30) test the relation between profit and performance for forty football clubs over twenty years, and find weak evidence that the two correlate positively. I assume that performance creates greater revenues than grows costs, and thus, the second hypothesis is stated as follows:

H_2: Profit and performance are positively related

4.1.2 Hypotheses on games, trading activity, and returns

The third hypothesis concentrates on whether or not the market responds to the game results, i.e. whether the investors use game results to revise their expectations of future cash flows. Ball and Brown (1968), Brown (1978), Watts (1978), and Aharony and Swary (1980) observe a revision of stock prices associated with the release of earnings information. Brown and Hartzell (2001) find evidence of game results affecting the returns and trading activity of the Boston Celtics' shares. Trading volumes and volatility are higher the day after the game. Also, both volumes and volatilities were higher on-season than off-season. However, even if games contain information about future cash flows from the firm, transaction costs could wash away any observable effect on the clubs' share price. Investors might accumulate information until their revisions are large enough to justify action. I formulate the third hypothesis as follows:

H_3: Returns and trading activity (e.g., volume and volatility) in the shares of the football clubs are related to team performance (i.e., game results).

The fourth hypothesis tests whether the responses to wins and losses are symmetric. There is no obvious reason to expect that investors would react asymmetrically to wins and losses. It is also difficult to forecast how the market reacts to draws. However, Brown and Hartzell (2001) find that the market reaction to losses is more significant than to wins.

H_4. Investors (and therefore returns) respond symmetrically to positive and negative (unexpected) team performance. The effect on returns should be equal in magnitude for unexpected wins and unexpected losses.

In addition to volume and volatility, games can affect returns. In an efficient market, if shares are trading on financial performance and financial performance is in turn based on the team's performance, the expected team results should be incorporated into the share price before the games are played. If the team wins, but the market expected them to, the game might have no new information about the firm's future cash flows. Many researchers, such as Rendleman, Jones and Latané (1982), Bamber (1986), and Datta and Dhillon (1993) have found a relation between unexpected information and reaction in share prices or trading behavior. Also, Pearce and Roley (1983) find that stock prices respond only to the unanticipated changes in the money supply, as predicted by the efficient market hypothesis. Consequently, there is no reason to expect a strong relation between game outcomes that are unadjusted for the expected result and changes in the clubs' share price. A way to capture these market expectations is to use the betting market odds.

With a couple of exceptions, the empirical evidence supports the assertion that point spreads are unbiased predictors of game outcomes [see Sauer (1998) for a review of the literature]. The results of earlier studies utilizing small samples are not so promising. For example, Zuber et al. (1985) and Amoako-Adu et al. (1985) find little evidence of a statistical relation between point spreads and actual outcomes. However, later studies use larger samples of NFL and NBA games and find greater evidence on an efficient betting market. Sauer et al. (1988), Gandar et al. (1988), and Dare and McDonald (1996) cannot reject the null hypothesis that the betting market is efficient, at least to the point at which profit opportunities exist. Betting market fixed odds can be considered analogous to point spreads. Testing the following hypothesis is also a means of testing for market integration: trying to assess whether the two markets of interest, the stock market and the betting market, reflect similar expectations. Thus, I form the hypothesis as follows:

H_5. The market reacts more strongly to the unexpected outcome than to expected outcome.

The hypothesized effects of expected and realized game outcomes to mean market-adjusted returns are presented in Table 1.

Table 1 Mean returns and expected game outcome, hypothesized effects

This table presents the hypothesized effects for the market-adjusted returns. Expected result is split into four point categories. Expected points are calculated from the betting market fixed odds converted to probabilities and multiplied by outcome payoff (three points from a win, one point from a draw, and zero from a loss).

	Expected result (points)			
Realized event	0 - 0.75	0.75 - 1.5	1.5 - 2.25	2.25 - 3
Win				
mean post-game return	+++	++	+	0
Draw				
mean post-game return	+	0	-	--
Loss				
mean post-game return	0	-	--	---

The sixth hypothesis concentrates on the importance of cup and international game results as signals for the clubs' financial performance and seeks to quantify the extent to which major game-related events carry implications for the share prices of football clubs floated on the stock exchange. If new information about team performance is transmitted and absorbed by the markets rapidly, a direct link between fluctuations in fortunes on the field and variations in share prices should be discernible empirically. Brown and Hartzell (2001) find that playoff games affect more on returns than regular-season games. Following Dobson and Goddard (2001) I expect a greater impact on abnormal returns to be generated subsequent to promotion and relegation games (positive and negative impact, respectively), and a negative effect from the elimination from the domestic and international cup competition as the top league levels (FA Premier League, Serie A, Bundesliga 1 etc.) and European competitions guarantee substantially higher (future) income in terms of television broadcasting rights and sponsoring income etc. Thus, the following hypothesis:

H_6. The European competitions, national cups and relegation/promotion games have a more significant impact on returns than league games.

4.2 Hypothesis on the timeliness of information

Games represent substantial public information that is not revealed during normal business hours, since they are played when the market is at night or weekends, when the market is closed. This leaves the empirical question of when and if the game results are incorporated into the share price. According to Brown and Hartzell (2001), if the price-relevant information in games is a primarily objective (public) reassessment of future cash flows or risk, then the price should adjust while the market is closed, re-opening at a new equilibrium price. If the price-relevant information is evaluated subjectively (privately), then the price will respond as investors trade on it, when the market is open. French and Roll (1986) give evidence that most of the information on which investors trade is private. Hence, the following hypothesis:

H_7: If there is a private component to game-related information, it will not affect prices until after the market has opened.

4.3 Hypotheses on management turnover

This subchapter presents the two final hypotheses of the study. First, the hypothesis related to the managerial change and team performance is presented. The latter part discusses the event study tested hypothesis on the stock market reaction to managerial changes in listed football clubs.

4.3.1 Hypothesis on managerial change and team performance

In professional football in the UK and elsewhere, one of the most widely remarked characteristics of the manager's job is its chronic insecurity. Audas, Dobson, and Goddard (1997) study team performance and managerial change in the English Football League. They find a relation between team performance and managerial change: poor recent form drives managerial termination. Scully (1995) finds a significant relationship between a team's standing and the probability of a coach being retained or fired for most major-league baseball and basketball teams. Audas, Dobson, and Goddard (1999) find that short-term fluctuations in performance strongly influence the involuntary termination hazard for a football manager. Also, evidence from other businesses suggests that premature managerial terminations and poor firm performance are related, as in the studies by e.g. Dahya et al. (1998), Warner, Watts and Wruck (1988), and Kang and Shivdasani (1995). The eighth hypothesis of the study concentrates on the managerial changes and team performance.

H_8: Managerial change and team performance are negatively related.

4.3.2 Hypothesis on managerial change and stock market reaction

The future cash flow implications of managerial changes and player transfers are less clear than for example building a new stadium. However, given that playing performance has an impact on stock prices, and the manager and the players are the key factors in performance on the court, if there are benefits to shareholders from management change, then the research should reveal abnormal returns. Also, for example Bonnier and Bruner (1989), Furtado and Rozeff (1987), and Weisbach (1988) report significantly positive returns at the management-change announcements. Thus, the following hypotheses can be made:

H_9. Managerial changes manifest as abnormal returns.

4.4. Summary of hypotheses

Table 2 lists the hypotheses introduced in this chapter. The subsequent chapters present the data and methods used for testing these variables.

Table 2 Hypotheses of the study

Hypothesis	Formulation
H_1	Revenue and performance are positively related.
H_2	Profit and performance are positively related.
H_3	Returns and trading activity (e.g., volume and volatility) in the shares of the football clubs are related to team performance (i.e., game results).
H_4	Investors (and therefore returns) respond symmetrically to positive and negative (unexpected) team performance. The effect on returns should be equal in magnitude for unexpected wins and unexpected losses
H_5	The market reacts more strongly to the unexpected outcome than to expected outcome.
H_6	The European competitions, national cups and relegation/promotion games have a more significant impact on returns than league games
H_7	If there is a private component to game-related information, it will not affect prices until after the market has opened.
H_8	Managerial change and team performance are negatively related.
H_9	Managerial changes manifest as abnormal returns.

5 DATA

This chapter describes the data used. First, the chapter begins with the introduction of the sample clubs and stock market and financial data. Second, the data used in game-related analysis is presented, after which the sample of management changes is described. The chapter concludes by discussing some of the deficits and problems of the data.

5.1 Sample firms, stock market and financial data

This study employs a cross-sectional data on matches played by 32 stock market listed teams competing in seven different leagues during seasons 1998/99 to 2003/04. The sample size of firms is 32 clubs. Eighteen of the clubs are English, two are Scottish, six come from Denmark, three from Italy, and one from Germany, the Netherlands, and Portugal each. For some of the sample clubs the time period is shorter, due to a later listing to the stock market than the beginning date of the full sample or delisting before the end date of the full sample. Those clubs that had an initial public offering during the full sample period are allowed 20 trading days, or four weeks, for the prices and volumes to settle, before taking them into the sample. The sample firms, their home countries, listing dates, sample periods, and divisions from season 1997/98 to season 2004/05 are detailed in Appendix 1.

Daily stock prices, daily trading volumes, number of shares outstanding and the market capitalization for these firms are taken from Thomson's Datastream service for the sample period of August 1, 1998 to April 12, 2004. Stock prices that are used are open, close, high, and low prices. Also, the returns to the FTSE All Share index, Milan Comit General index, DAX 30 Performance index, AEX index, Copenhagen KBX Benchmark index, and Portugal PSI 20 index are taken from the Datastream service. Most of the financial statement data used for descriptive statistics and profit and performance analysis and ownership structure information are taken from the Amadeus database, and the Copenhagen Stock Exchange internet site (www.cse.dk). The time period for financial statement data is May 31, 1999 to December 31, 2004. The sample period for financial data varies between clubs, because all do not have data available from the earlier financial years.

5.2 Data for game-event analysis

The game-event and stock information (volume, market value, number of shares, open, close, high and low prices) sample for this study covers a time period from August 1, 1998 to April 12, 2004. Within this time period, there are five complete football seasons and one incomplete. The resulting sample contains 42,687 daily returns and 7,596 games, out of which 7,233 games had betting market odds data available. The English and Scottish Premier League teams play 38 league matches, the First Division or the Football League Championship and the Second Division or the Football League One teams 46 matches, the Danish First Division (premier level) 33, the Dutch KPN Eredivisie, the German Bundesliga 1, the Italian Serie A, and the Portuguese Superliga teams play 34 matches. In addition to league games, teams play variable amount of cup games, both domestic and international. In the sample, the minimum number of games played per season is 35 (Aalborg Boldspilklub, season 2001/2002), and the maximum number of games played per season is 63 (Manchester United, seasons 1998/99 and 2002/03). The average number of games played per season 49.

Matches that are researched are national league, national cup, and international games, such as Champions League, UEFA cup, and Intertoto games. The dates and results for national leagues, except for the Danish leagues, are taken from Football-data.co.uk (www.football-data.co.uk), as well as the historical odds data for national league matches from season 2000/2001 on. These odds data are collected from several betting companies (Gamebookers, Interwetten, William Hill, Sportingbet, Sporting Odds, Stanleybet, Ladbrokers, and Bet365). Cup and international game results and results for the Danish League are taken from the Internet Soccer Base (www.soccerbase.com), the Bet Explorer (www.betexplorer.com), and the Rec. Sport. Soccer Statistics Foundation (www.rsssf.com) along with information on managerial changes. For these matches and the league matches, the historical odds data are taken from BetBase (www.betbase.info), which has calculated average odds from several bookmakers.

5.3 Sample of management changes

Management change in this study is defined as a change in the main manager or coach of the football club. The sample is mainly collected from the Internet Soccer Base, which holds complete records for manager changes for English Premiership, Football League

Championship (English First Division), and Scottish Premiership clubs, the Association of Football Statisticians (www.11v11.co.uk), and from the club home pages. Clubs and managerial changes, for which exact dates and reliable data are not available, are omitted from the sample.

The managerial changes are studied from two perspectives. The first analysis concentrates on the relation between managerial change and team performance. The sample for the OLS regressions of managerial duration on team performance covers the time period from March 2, 1998 to October 21, 2005. For the managerial change to be included in the sample, the length of the managerial spell has to be at least five games. This results in 75 managerial changes from 25 of the 32 sample clubs. The number of managerial changes per club included in the sample is presented in Table 3. The sample does not distinguish whether the termination is voluntary or involuntary or whether the contract simply ended. Team performance is measured by using the data collected for the game-related analysis as described above.

Table 3 Managerial changes in team performance regression by sample club

This table presents the number of managerial changes per club during March 1998 – October 2005 that are included in the regressions testing the relation between managerial changes and team performance. Managerial spells that are shorter than five games are not included in the regressions.

Club	Country	Number of changes	Club	Country	Number of changes
Aston Villa	England	2	Watford	England	2
Birmingham City	England	1	West Bromwich Albion	England	3
Bolton Wanderers	England	1	Glasgow Celtic	Scotland	5
Chelsea	England	2	Heart of Mitlothian	Scotland	3
Leeds United	England	4	Aalborg IF	Denmark	3
Leicester City	England	3	AGF Kontrakfotbold	Denmark	5
Newcastle United	England	2	Brondbyernes IF FO	Denmark	3
Southampton	England	5	FC Copenhagen	Denmark	4
Tottenham Hotspur	England	5	SIF Fotbold	Denmark	2
Millwall	England	5	Borussia Dortmund	Germany	4
Preston North End	England	3	SS Lazio	Italy	1
Sheffield United	England	4	AFC Ajax	Holland	2
Sunderland	England	1			
			Total		75

The second analysis focuses on the managerial turnover and its effect on stock returns. For this sample, the managerial changes for the clubs are examined during their respective sample periods, which are detailed in Appendix 1. As above, the events, for which no reliable dates and information is available, are left out of the sample. These criteria results in a sample of 24 football clubs making a total of 79 management-change events for the analysis in the time period of August 1, 1998 to April 12, 2004. In eight cases, there is a management team of two coaches, which is interpreted as one event each. The number of managerial changes per club for the sample is detailed in Table 4. The event date is identified as the official date of the management change stated in the database or club homepages. The stock return data is collected from Datastream.

Table 4 Managerial changes for market-adjusted regressions by sample club

This table presents the number of managerial change events per club during August 1998 – March 2004 for the event study of managerial changes and cumulative abnormal returns.

Club	Country	Number of changes	Club	Country	Number of changes
Aston Villa	England	3	Sunderland	England	2
Birmingham City	England	2	Watford	England	1
Bolton Wanderers	England	2	West Bromwich Albion	England	4
Chelsea	England	2	Glasgow Celtic	Scotland	3
Leeds United	England	4	Heart of Mitlothian	Scotland	1
Leicester City	England	4	Aalborg	Denmark	4
Newcastle United	England	3	AGF Kontrakfotbold	Denmark	6
Southampton	England	5	Brondbyernes IF FO	Denmark	4
Tottenham Hotspur	England	5	FC Copenhagen	Denmark	7
Millwall	England	4	SIF Fotbold	Denmark	3
Preston North End	England	2	SS Lazio	Italy	2
Sheffield United	England	3	AFC Ajax	Holland	3
			Total		79

5.4 Deficits of the data

The data are not without some problems. For some of the matches during the sample period, no betting market odds are able. Many of these games that are missing the betting market data are domestic cup games, especially for other than English and Scottish cups. This may dilute the size of impact and the significance of cup games in the game-related analysis.

Furthermore, the managerial changes sample does not distinguish between voluntary termination, involuntary termination, and end of contract. As the sample is not partitioned according to the reason for termination and the unexpected terminations are not separated for analysis, the results may not show a significant stock market reaction to the managerial change announcements.

Daily trading volumes are somewhat inaccurate: trading volumes given by Datastream are rounded to hundreds. In addition, a more serious problem is that the stocks of football clubs are, in general, not heavily traded. Some of the companies in the sample are small in terms of market capitalization, personnel and sales, and for some of the listed football clubs the ownership is very concentrated. When sports teams carry out IPO's, it is very common for matters to be arranged so that a single individual or a tightly knit coalition of shareholders retains a controlling interest (Cheffins, 1999). Morrow (2003) states that in the football clubs in which the share capital has been opened up or the ownership broadened, in practice there is little evidence of selling by football club shareholders. Trading in football club shares, even in listed football clubs, which in theory should provide an active secondary market for shares, remains fairly illiquid (Morrow, 2000). According to Morrow (2003) thin trading can mostly be caused by the lack of buyers and sellers. On the supply side, concentrated ownership or control effectively reduces the availability. On the demand side, even in listed clubs there are few substantial holdings by institutions which might be expected to follow an active investment policy. Also, many individual shareholders are supporters, whose investments are primarily motivated by emotion rather than financial logic. Once purchased many supporter-shareholders are disinclined to see their shares as marketable assets, and hence are unlikely to exercise the disciplinary right of exit or sale (Morrow, 2000).

Due to the thin trading it may be difficult to distinguish the effects of game results to trading activity. However, previous research shows that. Many, if not most, listed stocks trade infrequently. On the London Stock Exchange, 50 % of listed stocks account for only 1.5 % of the trading volume, and over 1000 stocks average less than one trade a day (Easley et al., 1996). Infrequently traded stocks tend to have greater variability in order flow, with active days interspersed with slow days. When shares do trade, it is because traders are acting on private information. However, it can be also argued that less frequently traded stocks generally face lower risks of information-based trading due to the lack of financial analysts following these stocks. Brennan, Jegadeesh, and Swaminathan (1993) argue that stocks with more financial analysts adjust to information events more quickly than do 'neglected' stocks.

6 METHODOLOGY AND VARIABLES

This chapter describes the methods and variables used in the study. First, the methods for analyzing profit and performance are presented, after which the methods for volume and volatility are described, followed by presentation of the technique to measure (un)expectedness. Fourth, the market model used to calculate abnormal returns is described, after which the methods for the analysis of timeliness of information are introduced. The sixth subchapter presents the variables of the management change and team performance regressions. The seventh subchapter presents the event study method, and the statistical methods employed in the study conclude this chapter. The estimation work is generally done by using a statistical software package SPSS 12.0 for Windows or Excel.

6.1 Methods for revenues, profit, and performance

In an effort to test the relation between revenues, profitability and playing performance OLS regressions are conducted. The dependent variables are operating revenue and operating profit. The independent variables are league position for current and prior season, i.e. t and $t-1$, the percentage of points gained of maximum points from all games for t and $t-1$, and the percentage of points gained of maximum points from league games for t and $t-1$. In addition, dummy variables for each sport-year are added. To assess the model fit, the F-test is conducted and R^2 is calculated for each regression. In the following, the independent variables are explained in more detail.

League position, t and $t-1$, is measured as the position in a league in the end of each season. For example, if the club won the Premiership that season, it is assigned 1 for a league position. If the club won the First Division in England, it is assigned 21 for a league position, as there are 20 clubs ahead of it in the upper division. This is the approach adopted by Szymanski and Smith (1997). Szymanski and Kuypers (1999) use a log transformation of league ranking. In this study, this logarithmic variable is used to test the robustness of the results, and the results for this analysis are reported in Appendix 4.

Percentage of points gained of maximum points, all games, t and $t-1$ is calculated per season. In this variable, all games (league games, cup games, both domestic and international) played during the season are included. The variable is calculated as follows:

*% of max points, all games$_t$ = (number of wins$_t$ * 3 points/win+number of draws$_t$) /(number of games played$_t$ * 3 points/win)* **(Equation 1)**

Percentage of points gained of maximum points, league games, *t* and *t-1* is calculated in the same manner as for all games, but only league games are taken into account.

6.2 Methods for analyzing volume and volatility

In this thesis volatility is calculated by using two different measures for robustness' sake. These two measures are Parkinson's (1980) extreme value method and the Garman and Klass (1980) 'Best' Analytic Scale-invariant Estimator. Daily mean trading volume and volatility are calculated for different periods, and the non-parametric Mann-Whitney (U) test is used to determine the significance of the results. The daily volatility is annualized by multiplying it by the square root of the number of trading days, which in this study is 255 days. This modification is justified by reference to studies by French (1980) and French and Roll (1986).

6.2.1 Parkinson's (1980) extreme value method for estimating the variance of the rate of return

Parkinson's (1980) extreme value variance estimator is defined as the difference between the high and low price over each interval. The Parkinson number, also called high low range volatility, was developed to estimate the volatility of returns for a random walk using the high and low in any particular period. S_{Ht} is high stock's price in t day. S_{Lt} is low stock's price in t day. High/low return (x_t^{HL}) is calculated as the natural logarithm of the ratio of a high stock's price to low stock's price. Prices are observed on a fixed time interval and n is the number of days, or the interval, for which the estimator is calculated. In this thesis, $n = 1$.

Return

$$x_t^{HL} = \ln \frac{S_{H_t}}{S_{L_t}}$$ **(Equation 2)**

And Parkinson's number

$$HL\_HV_{daily} = \sqrt{\frac{\sum_{t=1}^{n} \frac{1}{4*\ln 2} * (x_t^{HL})^2}{n}} \qquad \textbf{(Equation 3)}$$

Parkinson (1980) derived that the extreme value method is far superior to the traditional method and much more sensitive to variations of dispersion. Wiggins (1991) concludes that the efficiency of the extreme-value variance estimator significantly exceeds that of the close-to-close estimator. Beckers (1983) states that the high-low estimator may contain information which is not reflected in the close-to-close variance.

6.2.2 Garman-Klass (1980) 'Best' Analytic Scale-Invariant Estimator

As another measure to test whether volatility differs across the subsamples I calculate the daily variance of returns using the Garman and Klass (1980) 'Best' Analytic Scale-Invariant Estimator. Garman and Klass develop further the idea first introduced by Parkinson (1980). The authors show that this estimator yields an estimated of variance about 7.4 times more efficient than an estimator using only close-to-close data. The estimator is based on the assumption that the logarithm of stock prices follows a Brownian motion with zero drift. The Garman and Klass Estimator has been used by e.g. Brown and Hartzell (2001). The formula for this 'Best' estimator of day *t* variance is:

$$\hat{\sigma}_t^2 \equiv 0.511(u_t - d_t)^2 - 0.019[c_t(u_t + d_t) - 2u_t d_t] - 0.383c_t^2, \qquad \textbf{(Equation 4)}$$

where u_t, d_t, and c_t are logarithms of daily high, low, and closing prices minus the opening price. Volatility is the square root of the 'Best' estimator, i.e. standard deviation.

6.3 Measuring (un)expectedness of results

The expectedness of an outcome is proxied by betting market fixed odds. Fixed odds, also called the 1X2 match betting odds, are presented as the odds from the bookmaker firm Bet365 for the Leeds United – Charlton Athletic match that took place on December 1, 2002:

1.8/3.25/4. The first of the figures, in this case 1.8, is the odds for home team win, the second the odds for a draw, and the last the odds for an away team win. The odds are the inverse of the probabilities of win, draw, or loss occurring with the bookmaker's profit margin added.

*Bookmaker's profit margin = (1/home team win odds + 1/draw odds + 1/away team win odds – 1) * 100%* **(Equation 5)**

The probabilities for outcomes are, after the profit margin is cleaned out, as follows:

P(home team win) = (1/home team win odds/(1/home team win odds + 1/draw odds + 1/away team win odds) **(Equation 6)**

P(draw) = (1/draw odds)/(1/home team win odds + 1/draw odds + 1/away team win odds) **(Equation 7)**

P(away team win) = (1/away team win odds)/(1/home team win odds + 1/draw odds + 1/away team win odds). **(Equation 8)**

This study uses the odds information given by several bookmakers. The profit-margin cleaned probabilities are averaged (arithmetically) across the bookmakers. To calculate the expected outcome, the probabilities are multiplied by the point payout of each outcome. Therefore, the expected outcome or points for a home team is:

*E(points for home team) = 3*P(home team win) + P(draw)* **(Equation 9)**

The expected outcome for the away team can be stated similarly, replacing the probability of home team win with the probability of away team win.

For regression analyses, a dependent variable proxying the unexpectedness of the outcome needs to be formed. The unexpectedness of the outcome is derived by subtracting the expected outcome for the team from the realized outcome for the team. Thus, the unexpectedness of a result can be formulated as follows:

$$\textit{Unexpected outcome}_{it} = \textit{Realized points}_{it} - E(\textit{points}_{it})$$ **(Equation 10)**

6.4 Methods for return analysis

Returns are calculated in this thesis in two different manners. For descriptive statistics, returns for securities are calculated as logarithmic price relative (not market-adjusted) as follows:

$$R_{i,t} = ln\ (C_t / C_{t-1}) * 100\% \qquad \textbf{(Equation 11)}$$

where $R_{i,t}$ is the daily return of a security i at time t, C_t is the closing price of a security i at time t, and C_{t-1} is the closing price of a security i at time $t-1$.

6.4.1 Market model residuals

The second method, which is used in the returns analysis that is tested statistically, is to calculate market-adjusted returns using the market model. The abnormal return can be derived by using the standard (single index) market model, discussed in Fama (1976). The market model assumes a linear relation between the return of any security to the return of the market portfolio. The return of a stock can be written as

$$R_{it} = \alpha_i + \beta_i R_{mt} + e_{it} \qquad \textbf{(Equation 12)}$$

with

$$E(e_{it}) = 0 \text{ and } Var(e_{it}) = \sigma^2_{e_{it}},$$

where α_i is the expected value for the component of security i's return that is independent of the market's performance – a random variable, R_{mt} is the rate of return on the market index, also a random variable, β_i is a constant that measures the expected change in R_i given a change in R_{mt}, and e_{it} is the unexpected component due to unexpected events that are relevant only to security i (firm specific) (e.g., Elton and Gruber, 1995, 130-132).

Thus, the abnormal return for a security i on a day t can be calculated as

$$e_{it} = AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt}) \qquad \textbf{(Equation 13)}$$

However, there may be a problem with infrequent trading and the market model estimates, as the sample includes many infrequently traded stocks. The easiest way to avoid downward biased β-estimates is to extend the period over which the market model parameters are estimated. Thus, the parameters in this study are estimated from weekly instead of daily data and the estimation period is the full sample period from August 1, 1998 to April 14, 2004. A few firms have a different sample, and thus, estimation period due to a later IPO date or delisting. The sample period of each club is detailed in Appendix 1. The basic version of the market model is then estimated using the ordinary least squares (OLS) method as follows:

$$R_{iw} = \alpha_i + \beta_i R_{mw} + e_i \qquad \textbf{(Equation 14)}$$

where R_{iw} is the expected return for security i on week w and R_{mw} is the rate of return on the local market index on week w. The returns are calculated from Wednesday to Wednesday. The estimated $\hat{\alpha}_i$ from weekly return intervals presents a return for one week. This is converted to a daily interval, $\hat{\alpha}_{id}$, using $\hat{\alpha}_{id} = (1+\hat{\alpha}_{iw})^{1/5} - 1$. The next step is to estimate abnormal returns (AR) on day t for a given security. The residual term from the market model is used to measure risk-adjusted abnormal return:

$$AR_{it} = \hat{e}_{it} = R_{it} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{mt}\right), \qquad \textbf{(Equation 15)}$$

where R_{it} is the observed continuously compounded return for security i on day t.

To test whether returns are related to game results, and whether returns respond symmetrically to positive and negative performance, post-game market-adjusted returns, are grouped by unadjusted game outcome. To analyze the importance of actual outcome versus ex ante expectations post-game market-adjusted returns are also grouped by the expected game outcome and the realized outcome. There are in total 12 unexpected outcome groups. The abnormal returns for outcomes are averaged across the observations according to:

$$AR_{t,outcome} = \frac{1}{N}\sum_{i=1}^{N} e_{it,outcome} \qquad \textbf{(Equation 16)}$$

where N is the number of observations (wins, draws, and losses, or each of the 12 unexpected outcome groups) in the sample and $e_{it,outcome}$ is the excess daily return on security i on day t, selected based on the outcome, expectation unadjusted or adjusted.

To test the significance of each group (i.e., win, draw, loss, or one of the 12 unexpected outcome groups), a standard t-test is applied. Each group is tested against the null hypothesis of zero mean and the means of each group are also compared to each other, i.e. the difference-in means tests. To test for the symmetry of reaction to wins and losses, both unadjusted and adjusted for expectations, F-tests are run.

6.4.2 Regressions on game variables

To determine if different games have a different impact on the returns, a regression analysis is conducted with abnormal return as the dependent variable and unexpected outcome and the interaction variable of unexpected outcome and cup game dummy as the independent variables. The following equation is estimated:

$$AR_t = \beta_0 + \beta_1 * UnexpectedOutcome_{it} +$$
$$\beta_2 * UnexpectedOutcome_{it} CupGameDummy_{it} + \varepsilon_{it}, \qquad \textbf{(Equation 17)}$$

where AR_t is the club' abnormal return on a post-game trading day and $UnexpectedOutcome_{it}$ is as described above. The $CupGameDummy_{it}$ variable is equal to one when a cup game took place after the previous trading day and zero otherwise.

It is expected that events such as promotion and relegation, or narrowly missing promotion and avoiding relegation, will affect investors' assessment of the club's future profitability, to a greater extent than would normally be expected from the result of an individual match that finally determines the team's fate. The fate may be either resting on the outcome of the final match of the regular league season or outcome of play-off matches (Dobson and Goddard, 2001, 384). Dobson and Goddard (2001) also suggest that elimination from European competitions or FA Cup is the event most likely to cause a discernible share price reaction[3]

[3] Winning a cup tie merely guarantees that the team will play another tie in the same tournament, with the prospect of further ties (and more revenue), but only for as long as the team avoids defeat. Winning either the FA Cup or a European tournament guarantees directly lucrative admission to one of the next season's European

Event dummies are likely to capture the share price reaction on each of the three trading days immediately following the relegation or promotion events, or elimination from the cups. To investigate the impact of international competitions, national cups, and relegation and promotion games on returns, following Dobson and Goddard (2001) in the formulation of the dummy variables, the ensuing equation is formulated:

$$AR_t = \gamma_0 + \gamma_1 UnexpectedOutcome_{it} + \gamma_2 U_{i1t} + \gamma_3 D_{i1t} + \gamma_4 F_{i1t} + \gamma_5 E_{i1t}$$
$$+ \gamma_6 U_{i2t} + \gamma_7 D_{i2t} + \gamma_8 F_{i2t} + \gamma_9 E_{i2t} + \gamma_{10} U_{i3t} + \gamma_{11} D_{i3t} + \gamma_{12} F_{i3t} + \gamma_{13} E_{i3t} + \varepsilon_{it}, \qquad \textbf{(Equation 18)}$$

where

U_{ikt} = 1 on trading dayt t if team i gained promotion or avoided relegation as a result of a match played between trading days t-k and t-k+1, for k = 1, 2, or 3, and 0 elsewhere

D_{ikt} = 1 on trading day t if team i was relegated or failed to win promotion as a result of a match played between trading days t-k and t-k+1, for k = 1, 2, or 3, and 0 elsewhere

F_{ikt} = 1 on trading dayt t if team i was eliminated from a domestic cup between trading days t-k and t-k+1, for k = 1, 2, or 3, and 0 elsewhere

E_{ikt} = 1 on trading dayt t if team i was eliminated from a European competition between trading days t-k and t-k+1, for k = 1, 2, or 3, and 0 elsewhere.

The actual events during the sample period and number of dummy variables for promotion or avoiding relegation and relegation or missing promotion are detailed by club in Table 4. The events of European competition eliminations and the domestic cup wins by club along with the number of dummy variables per club for the sample period are detailed in Table 5. Appendix 5 details the league winners for the sample period of 1998/99 season to 2003/2004 season in the countries from where there are clubs in the sample. Appendix 6 presents the domestic cup winners for the same sample period and countries. Appendix 7 details the international cup winners for the sample period. The cups that are presented are Champions' League, UEFA Cup, Cup Winners' Cup (only for season 1998/99 - the final year it was played), and Intertoto Cup.

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tournaments. Losing a cup tie, on the other hand, guarantees automatically that no further revenue will be earned from that season's cup competition, and closes off a possible route into Europe for the following season. (Dobson and Goddard, 2001, 385)

Table 5 Dummy variables for regressions of market-adjusted returns on game result variable: promotion and relegation

This table details the dummy variables related to promotion and relegation used in the regressions of market-adjusted returns on game result variables. The events for the dummy variables *Promotion or avoid relegation*, $U_{i,k,t}$ and *Relegation or miss promotion*, $D_{i,k,t}$ are listed in the table, as well as the total number of events applied in the regressions. For these events, dummy variables are included for up to three days after each event, to allow for the possibility that it takes several days for reappraisal of a club's futures profit potential to be completed.

Club	Promotion or avoid relegation, $U_{i,k,t}$	Relegation or miss promotion, $D_{i,k,t}$	$U_{i,k,t}$, number of events	$D_{i,k,t}$, number of events
Aalborg Boldspilklub	-	-	0	0
Aarhus AGF Kontraktfodbold	Avoided relegation from Danish Premier League in 1999, 2000, 2002, and 2003	-	4	0
Akademisk Boldspilklub	Avoided relegation from Danish Premier League in 2001	-	1	0
AFC Ajax	-	-	0	0
Arsenal Holdings	-	-	0	0
AS Roma	-	-	0	0
Aston Villa	Avoided relegation from Premier League in 2003	-	1	0
Birmingham City	Promoted from English First Division in 2002	Missed promotion from English First Division in 1999, 2000, 2001	1	3
Borussia Dortmund	-	-	0	0
Brondby IF	-	-	0	0
Burnden Leisure (Bolton Wanderers)	Promoted from English First Division in 2001; Avoided relegation from Premier League in 2002	Missed promotion from English First Division in 1999, 2000	2	2
-	N/A	-	0	0
Charlton Athletic	Promoted from English First Division in 2000	Relegated from Premier League in 1999	1	1
Chelsea Village	-	-	0	0
Heart of Midlothian	-	-	0	0
Juventus	-	-	0	0
Leeds United	-	-	0	0
Leicester City	-	Relegated from Premier League in 2002	0	1

(continued)

Table 5 continued

Club	Promotion or avoid relegation, $U_{i,k,t}$	Relegation or miss promotion, $D_{i,k,t}$	$U_{i,k,t,}$ number of events	$D_{i,k,t,}$ number of events
Manchester United	-	-	0	0
Millwall Holdings	Promoted to English Division 1 in 2001	Missed promotion from English 2nd Division in 2001; Missed promotion from English 1st Division in 2002.	1	2
Newcastle United	-	-	0	0
Parken Sport & Entertainment (FCK)	-	-	0	0
Preston North End	Promoted to English Division 1 in 2000	Missed promotion from English 2nd Division in 1999; Missed promotion from English 1st Division in 2001	1	2
Sheffield United	-	Missed promotion from English 1st Division in 2003	0	1
Silkeborg IF	-	Relegated from D1 in 2003	0	1
Southampton Leisure Holdings	Avoided relegation from Premier League in 1999	-	1	0
Sporting Lisbon	-	-	0	0
SS Lazio	-	-	0	0
Sunderland	Promoted to Premier League in 1999; Avoided relegation in 2002	Relegated from Premier League in 2003	2	1
Tottenham Hotspur	-	-	0	0
Watford Leisure	-	-	0	0
West Bromwich Albion	Avoided relegation from English First Division in 2000; Promoted to Premier League in 2002	Missed promotion from English 1st Division in 2001; Relegated from Premier League in 2003	2	2
Total number of events			17	16

Table 6 Dummy variables for regressions of market-adjusted returns on game result variables: domestic cups and European competitions

This table presents the dummy variables used in the regressions of market-adjusted returns on game result variables. The number of events for the dummy variables *European competition elimination,* $E_{i,k,t}$ and *Domestic cup elimination,* $F_{i,k,}$ are determined by cup competition participation and failure to win the cup. European competition eliminations and both international and domestic cup wins are listed in the table, as well as the total number of events applied in the regressions. For these events, dummy variables are included for up to three days after each event, to allow for the possibility that it takes several days for reappraisal of a club's futures profit potential to be completed. CL is an abbreviation for Champions' League, also known as European Cup.

Club	European competition elimination during sample period, $E_{i,k,t}$	Cup wins during sample period	$E_{i,k,t}$, number of events	$F_{i,k,t}$, number of events
Aalborg Boldspilklub	CL 1999-2000; UEFA Cup 1999-2000, Intertoto Cup 2000	-	3	5
Aarhus AGF Kontraktfodbold	Intertoto Cup 2001	-	1	6
Akademisk Boldspilklub	UEFA Cup 1999-2000, 2000-2001, Intertoto Cup 2002	Danish Cup 1998-1999	3	5
AFC Ajax	CL 1998-1999, 2001-2002, 2002-2003, 2003-2004; UEFA Cup 1999-2000, 2000-2001, 2001-2002	Dutch Cup 1998-1999, 2001-2002	7	4
Arsenal Holdings	CL 2002-2003, 2003-2004	FA Cup 2002-2003	2	3
AS Roma	CL 2001-2002, 2002-2003; UEFA Cup 2000-2001, 2003-2004	-	4	4
Aston Villa	UEFA Cup 1998-1999, 2000-2001; Intertoto Cup 2000, 2001, 2002	Intertoto Cup 2001	4	12
Birmingham City	-	-	0	12
Borussia Dortmund	CL 2002-2003, 2003-2004; UEFA Cup 2001-2002, 2003-2004	-	4	7
Brondby IF	CL 1998-1999, 1999-2000, 2000-2001, 2002-2003; UEFA Cup 1999-2000, 2000-2001, 2001-2002, 2002-2003, 2003-2004	Danish Cup 2002-2003	9	4
Burnden Leisure (Bolton Wanderers)	-	-	0	10
Celtic	CL 1998-1999, 2001-2002, 2002-2003, 2003-2004; UEFA Cup 1998-1999, 1999-2000, 2000-2001, 2001-2002, 2002-2003	Scottish FA Cup 2000-2001, 2003-2004; Scottish League Cup 1999-2000, 2000-2001	9	8
Charlton Athletic	-	-	0	12

(continued)

Table 6 continued

Club	European competition elimination during sample period, $E_{i,k,t}$	Cup wins during sample period	$E_{i,k,t}$, number of events	$F_{i,k,t}$, number of events
Chelsea Village	European Cup Winners' Cup 1998-1999; CL 1999-2000; UEFA Cup 2000-2001, 2001-2002, 2002-2003	FA Cup 1999-2000	5	9
Heart of Midlothian	European Cup Winners' Cup 1998-1999; UEFA Cup 2000-2001, 2003-2004	-	3	12
Juventus	CL 2001-2002, 2002-2003, 2003-2004	-	3	3
Leeds United	CL 2000-2001; UEFA Cup 1998-1999, 1999-2000, 2001-2002, 2002-2003	-	5	12
Leicester City	UEFA Cup 2000-2001	English League Cup 1999-2000	1	7
Manchester United	CL 1999-2000, 2000-2001, 2001-2002, 2002-2003, 2003-2004	European Cup 1998-1999; FA Cup 1998-1999, 2003-2004	5	9
Millwall Holdings	-	-	0	14
Newcastle United	European Cup Winners' Cup 1998-1999; CL 2002-2003, 2003-2004; UEFA Cup 1999-2000, 2003-2004 (not included); Intertoto Cup 2001	-	5	12
Parken Sport & Entertainment (FCK)	European Cup Winners' Cup 1998-1999; CL 2001-2002, 2003-2004; UEFA Cup 2001-2002, 2002-2003, 2003-2004; Intertoto Cup 1999	Danish Cup 2003-2004	7	5
Preston North End	-	-	0	14
Sheffield United	-	-	0	12
Silkeborg IF	UEFA Cup 1998-1999, 2001-2002; Intertoto Cup 2000	Danish Cup 2000-2001	3	5
Southampton Leisure Holdings	UEFA Cup 2003-2004	-	1	12
Sporting Lisbon	CL 2000-2001, 2002-2003; UEFA Cup 1998-1999, 1999-2000, 2001-2002, 2002-2003, 2003-2004	Portugal Cup 2001-2002	7	5
SS Lazio	CL 1999-2000, 2000-2001, 2001-2002, 2003-2004; UEFA Cup 2002-2003	European Cup Winners' Cup 1998-1999; Italy Cup 1999-2000, 2003-2004	5	4
Sunderland	-	-	0	12
Tottenham Hotspur	UEFA Cup 1999-2000	English League Cup 1998-1999	1	11
Watford Leisure	-	-	0	6
West Bromwich Albion	-	-	0	12
Total number of events			97	268

N.B. Manchester United did not participate in FA Cup in season 1999-2000, as it played in FIFA World Cup Championship

6.5 Methods for analyzing the timeliness of information effects

To analyze timeliness of information effects, two volatility series using daily opening and closing price are constructed. The volatility calculation formulas follows those of Brown and Hartzell (2001). Closed-market volatility is defined as the absolute percentage change from the previous day's close to the open

$$\textit{Closed-market volatility}_{it} = (O_{it} - C_{it-1}) / C_{it-1} \qquad \textbf{(Equation 19)}$$

where O_{it} is the opening price for security i on trading day t and C_{it-1} is the closing price for security i on trading day $t-1$. Open-market volatility is defined as the absolute percentage price change from the open to the close

$$\textit{Open-market volatility}_{it} = (C_{it} - O_{it}) / O_{it} \qquad \textbf{(Equation 20)}$$

where C_{it} is the closing price for security i on trading day t. The volatilities are annualized by multiplying them by the square root of 510, since there are on average this many total open- and closed-market periods each year during the sample (255 trading days per year). The Mann-Whitney (U) test, which is described in chapter 6.8.1, is used to investigate whether the differences between open- and closed-market volatilities for the full sample period, for post-game trading days and trading days that had no game since last trading day.

6.6 Methods for analyzing the managerial changes and team performance

This study employs OLS regressions to analyze the effect of team performance on managerial duration. The dependent variable used is managerial duration measured as the natural logarithm of the number of all games played during the spell. The independent variables proxying for team performance are presented in the following.

Percentage of points gained of maximum points, all games, whole spell and **current season** includes league games and cup games, both domestic and international and follows the logic of Equation 1. The current season variable takes into account the game outcomes from the beginning of the season to the date of managerial change.

Percentage of points gained of maximum points, league games, whole spell and current season and **percentage of points gained of maximum points, cup games, whole spell** are calculated in the same manner as for all games, but only league or cup games are taken into account. The predictors **percentage of points gained of maximum available points in all games** and **league games** from one to six games, from seven to 12 games, from 13 to 18 games before termination also follow the same logic as above.

Nine different regression models are constructed using these variables, based on the principles of regression analysis as for example:

$$\textit{Managerial duration}_i = \beta_0 + \beta_1 \textit{ \% of max. points, league games}_{i\ whole\ spell} + \beta_2 \textit{ \% of max. points, cup games}_{i,\ whole\ spell} + \varepsilon_{it} \quad \textbf{(Equation 21)}$$

To assess the model fit, the *F*-test is conducted and R^2 is calculated for each regression.

6.7 Event study method

The non-game events and the reaction on the stock market of the study – managerial changes - are studied with an event study method. Event can be constituted as an announcement and usually an announcement emanating from a firm. However, announcements from outside of firms or more general 'happenings' are also includable as events. The event studies have their roots in the study by Ball and Brown (1968) and the seminal paper of Fama, Fisher, Jensen and Roll (1969). Initially, the purpose of the event study was to explain if the market was efficient and how fast the information was incorporated in share price, but now the event study is generally used to evaluate the effect of certain events, such as managerial change and earnings announcements, on the share price and thus, shareholder value.

The following will present a brief outline on conducting an event study. For further reference, Elton and Gruber (1995) provide a clear presentation of the aspects of the event study method, and Brown and Warner (1980, 1985) examine various statistical problems with respect to the event studies. As an example of conducting an event study to examine the effects of a management change, see Bonnier and Bruner (1989).

First, the event period is determined and normal returns are defined. The event period applied in this research is 50 period before the event and 50 days after. Abnormal returns are calculated for each day during the event period. Also, cumulative abnormal returns are calculated for the periods and different intervals. Normal return is defined as a security's expected return under normal conditions, i.e. when no event takes place. Several methods can be used to estimate normal returns: the single-index model (constant mean return model), the market model, and the capital asset pricing model (CAPM) are the most widely used. In this study, the daily abnormal returns are generated employing the standard (single index) market model of security returns discussed in Fama (1976), which is presented in subchapter 6.4.1.

To avoid downward biased β-estimates, the parameters in this study are estimated from weekly instead of daily data. The basic version of the market model of Equation 14 is then estimated using the ordinary least squares (OLS) method. A maximum of 40 weeks prior to the event window, i.e. 200 trading days – from day -250 to day -51- before the management-change event, are used to estimate the returns. If return data is not available for all 40 weeks, the estimation period is extended to include missing number of weeks after the event window. The estimated α_i from weekly return intervals presents a return for one week. This is converted to a daily interval, $\hat{\alpha}_{id}$, using $\hat{\alpha}_{id} = (1+\hat{\alpha}_{iw})^{1/5} - 1$.

The next step is to estimate abnormal returns (*AR*) on day *t* for a given security. The residual term from the market model is used to measure risk-adjusted abnormal return, as in Equation 15. The average abnormal daily returns on a portfolio of stocks at any time *t* relative to event day equals:

$$AR_t = \frac{1}{N}\sum_{i=1}^{N} e_{it} \qquad \textbf{(Equation 22)}$$

where N is the number of observations in the sample and e_{it} is the excess daily return on security i on day t. The cumulative average abnormal return (CAR) at the time t relative to time t_0 is computed as:

$$CAR_{t_0}^{T} = \sum_{t_0}^{T} AR_t \qquad \textbf{(Equation 23)}$$

The reason for averaging across the sample is that individual stock returns may be noisy but averaging across a large number of firms tends to cancel out the noise. Thus, the more firms in sample, the better the ability to distinguish the event from the return data.

In order to assess the statistical significance of abnormal returns, a *t*-test is required. Assuming that security daily abnormal returns are independently and identically distributed in the event time, portfolio daily abnormal returns approach normal distribution for large samples under Central Limit Theorem. The *t*-statistic is then calculated as:

$$t_{AR} = \frac{AR_t}{\hat{\sigma}(AR_t)} \sim t(N-1) \qquad \textbf{(Equation 24)}$$

which is distributed Student-*t* with 199 degrees of freedom (estimation period is N=200 days) for the assumed normal and independent e_{it}s and where $\hat{\sigma}(AR_t)$ is the sample standard deviation of the portfolio returns during the control period estimated over the 200 days, or 40 weeks, - 250 to –51, calculated as:

$$\hat{\sigma}(AR_t) = \sqrt{\sum_{-250}^{-51}(AR_t - \overline{AR_t})^2 / 199}\,, \qquad \textbf{(Equation 25)}$$

where $\overline{AR_t}$ is the average portfolio abnormal return during the control period. In order to test whether the cumulative abnormal return from day *t* until *t+n* is significantly different from 0, a *t*-statistic is computed:

$$t = \frac{CAR_t^{t+n}}{\sqrt{n} * \hat{\sigma}(AR_t)}, \qquad \textbf{(Equation 26)}$$

where *n* is the number of days in the event window and $\hat{\sigma}(AR_t)$ is the sample standard deviation of the portfolio abnormal returns as before.

6.7 Statistical methods

This subchapter presents the statistical methods used in this thesis. First, the Mann-Whitney (U) test is discussed, followed by *t*-test and the difference-in means test, *F*-test, and regression analysis, which concludes the section.

6.7.1 Mann-Whitney (U) test

Mann and Whitney (1947) propose a statistical test that uses the rank sums of two samples. Their test can be shown to be equivalent to the Wilcoxon (1945) rank sum test[4] The Mann-Whitney (U) test allows to test whether the values for one sample tend to be higher or lower than for the second sample. In this study, the Mann-Whitney (U) test is used for testing volumes, volatilities, and returns.

The formulas for the two values of U, which are denoted as U_A and U_B are as follows:

$$U_A = n_1 n_2 + n_1(n_1 + 1)/2 - T_A \qquad \textbf{(Equation 27a)}$$

$$U_B = n_1 n_2 + n_2(n_2 + 1)/2 - T_B \qquad \textbf{(Equation 27b)}$$

where $U_A + U_B = n_1 n_2$, n_1 and n_2 are sample sizes from two populations A and B and T_A and T_B are the rank sums for samples A and B, respectively.

The formula for the Mann-Whitney U statistic can be given in terms of T_A or of T_B, one value of U being larger than the other, but the sum of the two U values will always equal $n_1 n_2$. The smaller value of U is always used as a test statistic. (Mendenhall et al., 1986, 789-790)

[4] The Wilcoxon rank-sum test, also called the signed-rank test, is a nonparametric statistical test of the difference between two treatments using paired observations. The differences are ranked according to their absolute magnitude and each rank is given the sign of the original difference. The sum of the positive or negative ranks provides the test statistic developed by Wilcoxon. (Mendenhall et al., 1986, 935)

6.7.2 t-test

To test the significance of the individual returns, a standard t-test is applied. The difference of a given return from population mean return is tested as follows. Given n independent measurements x_i,

$$t = \frac{\bar{y} - \mu}{s / \sqrt{n}}$$ **(Equation 28)**

where $\bar{y}$ is the sample mean, μ denotes to the population mean and s is the estimator for population standard deviation, with $(n - 1)$ degrees of freedom (Mendenhall et al., 1986, 360). Thus, the test statistic for testing whether the mean market-model adjusted returns for wins are different from zero is

$$t_{win} = \frac{AR_{win}}{s_{win} / \sqrt{n_{win}}}$$ **(Equation 29)**

where AR_{win} is the mean abnormal return for wins, s_{win} is the sample standard deviation of the abnormal returns for wins, and n_{win} is the number of win observations. The test statistic is computed in a similar manner for draws and losses, and the 12 expectation-adjusted categories.

6.7.3 Difference-in means test

To test for the difference between two means, independent random samples of n_1 and n_2 measurements, respectively, are drawn from two populations, which possess means and variances μ_1, σ_1^2 and μ_2, σ_2^2. The objective is to make inferences concerning the difference $(\mu_1 - \mu_2)$ between the two population means. To test this, it is assumed that both populations possess a normal probability distribution and that the population variances σ_1^2 and σ_2^2 are equal. The point estimator of $(\mu_1 - \mu_2)$ is $(\bar{y}_1 - \bar{y}_2)$, the difference between the sample means.

The pooled estimator of σ^2 is calculated as the weighted average of standard deviation of each sample (s_1 and s_2), using the degrees of freedom of the samples (n_1-1) and (n_2-1) as weights:

$$s^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{(n_1 - 1) + (n_2 - 1)} \qquad \textbf{(Equation 30)}$$

with $(n_1 - 1) + (n_2 - 1) = n_1 + n_2 - 2$ degrees of freedom.

The null hypothesis is that the two means, μ_1 and μ_2, are equal, or in other words, their difference (D_0) is zero. The test statistic for the difference between two means is as follows

$$t = \frac{(\bar{y}_1 - \bar{y}_2) - (\mu_1 - \mu_2)}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \qquad \textbf{(Equation 31)}$$

with $(n_1 + n_2 - 2)$ degrees of freedom. s is the square root of s^2, the pooled estimator of σ^2, which is the common variance of the two populations. (Mendenhall et al., 1986, 369-371)

6.7.4 F-test

F-ratio is a test statistic with a known probability distribution (the *F*-distribution). It is the ratio of the average variability in the data that a given model can explain to the average variability unexplained by that same model. It is used to test the overall fit of the model in simple regression and multiple regression, and to test for overall differences between group means in experiments. (Field, 2005, 731)

F-test is performed to determine whether mean returns are equal. The test statistic for the null hypothesis $\mu_1 = \mu_2$ is

$$F = \frac{MST}{MSE} \qquad \textbf{(Equation 32)}$$

where

$$MST = \frac{SST}{v_1} = \frac{[n_1 n_2 / (n_1 + n_2)](\bar{y}_1 - \bar{y}_2)^2}{v_1} \qquad \textbf{(Equation 33)}$$

$$MSE = \frac{SSE}{v_2} = \frac{\sum_{i=1}^{2}\sum_{j=1}^{n_i}(y_{ij} - \bar{y}_i)^2}{(n_1 + n_2 - 2)}$$ **(Equation 34)**

MST is the mean square for treatments, MSE is the mean square for error, SST is the sum of squares for treatments, SSE is the sum of squares for error, v_1 is the degrees of freedom for MST = $t - 1$, t is number of normal populations and in this case 2, thus $v_1 = 1$, v_2 is the degrees of freedom for MSE, n_1 and n_2 are the sample sizes, $\bar{y}_1$ and $\bar{y}_2$ are the sample means, y_{ij} is the jth observation in the ith sample and y_i is the average of the observations in the ith sample, $i = 1, 2$.

When the null hypothesis is true (that is, $\mu_1 = \mu_2$), MSE (the mean square for error) and MST (the mean square for treatments) estimate the same quantity and should be 'roughly' of the same magnitude. When the null hypothesis is false and $\mu_1 \neq \mu_2$, MST will almost always be larger than MSE. (Mendenhall et al, 1986, 412-417)

6.7.5 Regression analysis

In this thesis the relations between operating revenue or profit and team performance, abnormal returns and game outcome variables, and managerial duration and team performance are studied with both simple and multiple regression. In the regression approach, past data on the relevant variables are used to develop and evaluate a prediction equation. The variable that is being predicted by this equation is the dependent variable. A variable that is being used to make the prediction is the independent variable.

In simple linear regression, there is a single independent variable, and the equation for prediction. A dependent variable y is a linear function of a given independent variable x. The constant term is the intercept term and is interpreted as the predicted value of y when $x = 0$. The coefficient of x is the slope of the line, the predicted change in y when there is one-unit change in x. The model is

$$y_i = \beta_0 + \beta_1 x_{i1} + \varepsilon_i .$$ **(Equation 35)**

Multiple regression is a method for using data to sort out the predictive value of the competing predictors. The coefficients of the predictor values are partial slopes and measure the predicted change in the dependent variable for a one-unit change in the independent variable, holding other independent variables constant. Based on the statistical data a linear model can be formed (Equation 36), which predicts value of dependent variable y_i based on independent variables $x_1 - x_k$. In addition to numeral variables qualitative dummy variables can also be used.

Symbolically, the multiple regression writes out as

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_k x_{ik} + \varepsilon_i \qquad \textbf{(Equation 36)}$$

where y_i is the dependent variable to be predicted, the x_i's are the independent predictor values and ε_i is the error term. The constant intercept term is β_0; β_1 through β_k are the coefficients, also called the partial slopes. They are calculated by fitting the model to the statistical data as well as possible. The error term ε_i, in other words residual, describes the difference between prediction calculated by the regression model and real value of y_i and thus includes all the effects of unpredictable and ignored factors. In this study 'goodness' and statistical significance of regression models are evaluated with traditional R^2- statistic and F-tests. Significance of single coefficients and predictions are approximated with t-tests. (Hildebrand and Ott, 1996)

7 EMPIRICAL FINDINGS

This chapter presents the empirical findings. The chapter begins by reviewing some descriptive statistics of the sample data and continues by presenting and briefly discussing the findings. The presentation of the empirical findings is partitioned into three main parts. At the beginning, the game-related analysis is presented. Of these, first the relation between revenue, profit, and team performance is discussed, followed by an analysis of trading activity and games. Third, the evidence from the returns is presented, and the fourth section provides a closer look at which games matter the most. The second main part portrays an analysis of the timeliness of information. After these analyses, the third main part introduces empirical results on managerial change: first, the relation between managerial changes and team performance and then, the event study of the managerial changes and cumulative abnormal returns. The summary of empirical findings and their relation to hypotheses are followed by a more elaborate discussion of the results concluding the chapter.

7.1 Descriptive statistics

This section presents financial data and descriptive statistics of the sample clubs, the market indices, game and betting market data, and the managerial change data.

7.1.1 Descriptive statistics of the sample

Table 7 details the financial data for the total sample of 32 stock market listed football clubs. For AGF Kontraktfodbold, Akademisk Boldklub, Heart of Midlothian, Preston North End, SIF Fodbold, Sporting Lisbon, and Watford Leisure no financial accounts data were available in the Amadeus database. For AGF Kontraktfodbold, Akademisk Boldklub, and SIF Fodbold data are derived from Copenhagen Stock Exchange (www.cse.dk). Market capitalization is presented both for the beginning of the sample and the end of the sample. For most of the clubs the sample period begins August 1' 1998 and ends April 12, 2004. However, due to IPO's and delistings the sample period may be different. The sample period for each club in the sample is detailed in Appendix 1. Three of the clubs delisted during the full sample period. These three are Burnden Leisure (Bolton Wanderers) on April 30th, 2003, Chelsea Village on August 22nd, 2003, and Leicester City on October 10th, 2002. More clubs included in the study sample have delisted since the last sample period date.[5]

The club with the highest market capitalization for the sample period is Manchester United, £642 million, and the lowest Akademisk Boldklub, only £0.45 million. Between the beginning and end dates of the sample periods, the market capitalization grew for six clubs and for 26 decreased. Manchester United has the highest operating revenue as well, £169 million, and SIF Fodbold the lowest, £2.4 million. Twelve clubs made a profit before tax and 16 a loss. Interestingly, Chelsea Village, and not Manchester United, has the highest asset

[5] By March 22nd, 2006, five further clubs have delisted: Heart of Midlothian, Leeds United, Manchester United, Sunderland, and West Bromwich Albion.

value, £367 million. One of the smallest of the clubs by many measures in the sample, Akademisk Boldklub, has the lowest asset value, £2.7 million.

Table 8 presents descriptive statistics of the financial data. The clubs differ notably from each other, for example in terms of market capitalization, total assets, and shareholders funds. The mean market capitalization in the end of the sample period is £48.6 million and operating revenue £57.0 million. On average, the clubs were unprofitable in 2004. The average current ratio is below one, 0.93, which indicates that as average net working capital is negative, some of the companies might not be on a healthy basis[6] (Ross et al., 1998, 55-56). Furthermore, the low average of solvency ratio, and especially some negative solvency ratios in the sample, indicates financial problems. The average number of employees for the firms was 398 persons in 2004.

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[6] Current ratio is defined as current assets divided by current liabilities. Net working capital is current assets less current liabilities.

Table 7 Financial data for the sample clubs

This table presents financial data for the sample clubs for the financial year ending in 2004. These data are derived from the Amadeus company database, Copenhagen Stock Exchange, and Thompson Datastream. The monetary figures are in thousands of British pounds. No financial data were available for four sample clubs from the sources.

Company	Market cap Apr. 12, 2004	Market cap Aug. 3, 1998	Operating revenue / turnover	Profit (loss) before tax	Cash flow	Total assets	Shareholders funds	Current ratio	Profit margin (%)	Solvency ratio (%)	Number of employees
Arsenal Holdings	91,350	72,500[d]	156,887	10,577	30,211	340,662	84,363	0.93	6.74	24.76	271
Aston Villa PLC	33,030	62,683	55,859	-10,652	3,448	60,423	37,744	0.43	-19.07	62.47	1,239
Birmingham City PLC	14,000	17,500	45,337	5,640	6,234	46,142	10,089	0.49	12.44	21.87	134
Burnden Leisure (Bolton Wanderers)	1,823[a]	27,060	48,763	2,642	4,398	56,118	313	0.21	5.42	0.56	196
Charlton Athletic PLC	11,543	15,773	42,606	11,118	12,378	58,214	27,845	1.16	26.09	47.83	220
Chelsea FC PLC	60,174[b]	120,996	152,123	-87,829	-25,687	366,741	67,134	0.31	-57.74	18.31	644
Leeds United PLC	9,559	42,213	64,005	-49,505	-45,457	86,981	-44,268	0.47	-77.35	-50.89	289
Leicester City Football Club PLC	2,990[c]	13,290	39,633	5,280	6,514	29,537	6,638	0.85	13.32	22.47	205
Manchester United PLC	642,346	428,621	169,080	27,907	26,012	283,397	173,354	1.77	16.51	61.17	504
Millwall Holdings PLC	14,258	10,320	10,162	-103	738	20,453	11,797	0.63	-1.01	57.68	119
Newcastle United PLC	58,838	108,145	90,161	4,220	7,671	166,312	32,336	0.91	4.68	19.44	1,376
Preston North End	4,120	8,040	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sheffield United PLC	8,740	12,235	11,837	-1,626	-603	25,069	5,358	0.2	-13.74	21.37	234
Southampton Leisure Holdings PLC	12,130	18,758	49,823	2,979	12,774	64,710	11,364	0.61	5.98	17.56	271
Sunderland Association Football Club, LTD	6,674	35,045	28,459	-599	815	30,713	-18,967	0.32	-2.1	-61.76	465
Tottenham Hotspur PLC	21,939	64,877	66,324	-2,464	-924	93,295	42,264	0.61	-3.72	45.3	819
Watford Leisure	7,358	25,625[e]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
West Bromwich Albion LTD	9,380	7,660	20,570	-110	841	34,499	14,971	0.52	-0.53	43.4	121
Celtic PLC	20,190	62,350	69,020	-7,471	-6,100	67,911	25,393	0.28	-10.82	37.39	493
Heart of Midlothian	3,980	9,866	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AS Roma	56,542	182,470[f]	72,778	-54,186	-8,341	199,395	24,729	0.49	-74.45	12.4	1,887
Juventus F.C. - S.P.A. O Juventus	110,498	264,778[g]	144,450	-13,977	31,609	242,377	54,144	0.66	-9.68	22.34	123
S.S. Lazio - S.P.A.O	32,759	91,982	67,416	-74,788	-25,757	233,979	-14,667	0.36	n.s.	-6.27	235
Borussia Dortmund GMBH	36,691	105,545[h]	66,800	-45,253	-26,059	155,330	54,019	5.53	-67.74	34.78	n.a.
AFC Ajax	93,439	146,294	59,884	10,155	18,100	70,962	49,193	1.58	16.96	69.32	245

(continues)

Table 7 continues

Company	Market cap Apr. 12, 2004	Market cap Aug. 3, 1998	Operating revenue / turnover	Profit (loss) before tax	Cash flow	Total assets	Sharehol ders funds	Current ratio	Profit margin (%)	Solvency ratio (%)	Number of employees
Aalborg Boldspilklub A/S	6,524	14,444[i]	7,343	-1,088	230	11,562	8,137	2.94	-14.81	70.38	98
AGF Kontraktfodbold	4,013	3,124	2,895	-1,522	N/A	3,077	-877	N/A	-52.27	-28.5	46
Akademisk Boldklub	449	10,915[j]	2,530	-39	N/A	2,378	847	N/A	-1.53	35.63	36
Brondbyernes IF Fodbold A/S	16,234	31,746	14,255	2,437	3,743	41,869	23,403	0.59	17.09	55.9	75
Parken Sport & Ent. (FCK)	60,006	30,044	33,292	3,659	4,197	103,016	44,296	0.73	10.99	43	301
SIF Fodbold	1,914	4,662	2,417	106	N/A	2,730	1,944	N/A	4.4	71.2	28
Sporting - Sociedade Desportiva de Futebol.	19,826	39,612	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Different market cap date a. Apr. 30, 2003; b. Aug.22, 2003; c. Oct. 10, 2002; d. Sept. 9, 2002; e. Aug. 29, 2001; f. Jun. 20, 2000; g. Jan. 16, 2002; h. Nov. 27, 2000; i. Oct. 12, 1998; j. Dec. 31, 1998.

Table 8 Descriptive statistics on the financial data

This table presents financial data for the sample clubs for the financial year ending in 2004, except for Leeds United (data from 2003). These data are derived from the Amadeus company database, Copenhagen Stock Exchange, and Thompson Datastream. All summary statistics are reported in their real values. No financial data, aside from market capitalization, were available for three sample clubs from the sources.

Variable	Mean	Median	Stdev	Min	Max	Skewness	Kurtosis	Observations
Market capitalization Apr. 12, 2004 (in thGBP)	48,563	14,258	118,011	449	642,346	4.87	25.03	29
Market capitalization Aug. 3, 1998 (in thGBP)	56,516	30,044	86,819	3,124	428,621	3.57	14.78	25
Operating revenue / turnover (in thGBP)	56,954	49,293	47,899	2,417	169,080	1.09	0.57	28
Profit (loss) before tax (in thGBP)	-9,446	-107	27,115	-87,829	27,907	-1.72	2.36	28
Cash flow (in thGBP)	1,239	3,448	17,767	-45,457	31,609	-0.70	1.11	25
Total assets (in thGBP)	103,495	62,567	104,525	2,378	366,741	1.28	0.66	28
Shareholders funds (in thGBP)	26,175	19,187	39,830	-44,268	173,354	1.84	6.18	28
Current ratio	0.94	0.61	1.13	0.2	5.53	3.25	11.87	25
Profit margin (%)	-9.86	-1.01	29.57	-77.35	26.09	-1.29	0.56	28
Solvency ratio (%)	27.47	29.77	33.74	-61.76	71.2	-1.08	1.19	28
Number of employees	395	235	450.19	28	1887	2.11	4.31	27

Table 9 presents the mean annual returns for the pooled sample and the local indices. The number of observations for on-season and off-season differs between markets, as the leagues run a different number of days in each country. Post-game day returns have not been calculated for FTSE All Share index, Milan Comit General Index, and Copenhagen KBX Benchmark index, as there are several clubs listed for the same index and the post-game trading days do not capture all the clubs simultaneously. Both the pooled club sample and the market indices, apart from the Copenhagen KBX Benchmark index, show a negative mean return for the full sample period. For the pooled club sample, the returns for the on-season trading days (-27.42%) are more negative on average than for the off-season trading days (-11.90%). This shows also on the post-game trading day returns, for which the mean annualized daily return is -32.28%.

Table 9 Descriptive statistics of mean annual returns

The table details mean annualized daily returns and the number of observations for the clubs and the indices in the sample over the August 1, 1998 to April 12, 2004 sample period, except for DAX 30 Performance index, for which the sample period is from November 27, 2000 to April 12, 2004.

Mean annual return	Full sample	On-season only	Off-season only	Post-game day only
All clubs	-23.42%	-27.40%	-11.90%	-32.28%
Observations	42,687	31,717	10,970	7,956
FTSE All Share index	-3.39%	0.53%	-17.94%	-
Observations	1,486	1,171	315	5,354
Milan Comit General index	-2.78%	8.15%	-31.46%	-
Observations	1,486	1,076	410	621
DAX 30 Performance index	-14.68%	-13.17%	-18.74%	20.25%
Observations	881	643	238	159
AEX index	-7.95%	-2.64%	-19.30%	-11.20%
Observations	1,486	1,012	474	262
Copenhagen KBX Benchmark index	1.92%	3.37%	-0.32%	-
Observations	1,486	903	583	1,299
Portugal PSI - 20 index	-4.73%	1.81%	-32.25%	1.37%
Observations	1,486	1,201	285	261

7.1.2 Descriptive statistics of the game and betting market data

Data on betting market fixed odds of some cup games are not available for the whole base sample but still for a large part of it. Table 10 presents descriptive statistics of the win-draw-loss record for the pooled sample. The returns are annualized daily raw returns. Wins have produced a post-game trading day mean return of 133.13%. The post-game trading day return for draws is negative, -70.87%. The return for losses on average is the most negative (-260.60%). The table also details the record of wins, draws, and losses in the sample. There are 7,956 games for the sample clubs during the period. For 7,233 games, betting market odds are available.

Table 10 Descriptive statistics of win-draw-loss record

The table details mean annualized daily returns per game outcome and the actual win-draw-loss record for the clubs over the August 1, 1998 to April 12, 2004 sample period.

	Wins	Draws	Losses	Total games
Mean annual return, all clubs	133.13%	-70.87%	-260.60%	-32.28%
Win-draw-loss record, all clubs	3,685	1,927	2,344	7,956
Games with odds reported				7,233

7.1.3 Descriptive statistics of the managerial change data

Table 11 reports some descriptive statistics on the variables in the managerial change and team performance regressions for the sample period of March 2, 1998 to October 21, 2005. The number of clubs in the sample is 24 and the number of managerial changes is 75. Only cases where the managerial spell is at least five games are included in the sample.

Table 11 Descriptive statistics of managerial changes and team performance

This table presents descriptive statistics for the 24 sample clubs for the sample period of March 2, 1998 to October 21, 2005. These data are derived from the Internet Soccer Database, Football-data.co.uk, the Rec. Sport. Soccer Statistics Foundation, and the clubs' homepages. Only managerial spells of at least five games are included in the sample.

Variable	Mean	Median	Stdev	Min	Max	Skewness	Kurtosis	Obs.
Managerial duration (days)	522.69	361	466.23	24	1800	1.18	0.56	75
Managerial duration (number of league games)	57.05	41	51.64	4	197	1.25	0.73	75
Managerial duration (number of all games)	69.91	51	66.38	5	282	1.42	1.35	75
% of max. points, all games, whole spell	49.84%	49.44%	0.13	12.82%	80.56%	0.09	0.59	75
% of max. points, all games, current season	46.60%	47.01%	0.16	6.67%	80.56%	-0.21	-0.28	75
% of max. points, league games, whole spell	48.90%	49.00%	0.14	12.12%	86.67%	0.11	0.77	75
% of max. points, league games, current season	45.34%	45.83%	0.17	6.67%	86.67%	-0.07	-0.29	75
% of max. points, cup games, whole spell	51.26%	51.52%	0.21	0.00%	100.00%	-0.21	1.44	66
% of max. points, 13-18 league games before termination	47.82%	47.22%	0.21	0.00%	88.89%	-0.03	-0.85	58
% of max. points, 7-12 league games before termination	45.15%	50.00%	0.21	0.00%	100.00%	0.18	0.06	63
% of max. points, 1-6 league games before termination	41.86%	44.44%	0.20	0.00%	88.89%	0.10	-0.55	73
% of max. points, 13-18 games (all) before termination	46.87%	47.22%	0.23	0.00%	100.00%	0.14	-0.60	60
% of max. points, 7-12 games (all) before termination	44.02%	50.00%	0.21	0.00%	100.00%	0.14	-0.20	66
% of max. points, 1-6 games (all) before termination	41.67%	44.44%	0.20	0.00%	88.89%	0.03	-0.59	74

7.2 Do games matter? Game-related analysis

The following pages present the results of the game-related analyses. First, the relation between income and playing performance is discussed. Then, the trading activity related to games is examined, followed by the analyses on the returns. This section is concluded by presenting returns and specific game events in more detail.

7.2.1 The relation between playing performance and income: empirical evidence

This section provides the empirical findings for the first hypothesis: *Revenue and performance are positively related*, and the second hypothesis: *Profit and performance are positively related.* Table 12 shows results on OLS regressions of operating revenue and operating profit on team performance for the 1999-2004 period. Team performance is measured as league position for years *t* and *t-1* and percentage of points gained of maximum available points in all games and league games in years *t* and *t-1*. Dummy variables for each sport-year are added to the analysis and presented in the table.

The relation between league position and operating revenue [regression (1) in table 12] is negative (the bigger the league position number, i.e. the worse the position, the less the operating revenue) and significant at the 0.05 level. Dropping down one position in league is associated with a £1.36 million decrease in operating revenue the same year. However, there seems to be no significant relation between lagged league position and operating revenue. The model fit for the regression between league position and operation is the best out of the six presented. R^2 is 0.345 and the F-ratio from the ANOVA test is 9.239, which is significant at the 0.001 level. None of the sport-year dummy variables are significant for this regression.

Both current and lagged percentages of points gained of maximum available points in all games are positively related to operating revenue and significant at the 0.01 level. An increase of one percentage point in current percentage of points gained in all games is associated with a £0.85 million increase in operating revenue. For lagged percentage of points gained in all games), an increase of one percentage point is associated with a £1.01 million increase in operating revenue. The model fit of regression (3) is not as good of regression (1). R^2 is 0.258, which is the lowest of the operating revenue regressions, and the F-ratio from the ANOVA test is 6.097, which is significant at the 0.001 level.

Table 12 Operating revenue, operating profit, and team performance

This table presents results of regressions of operating revenue and operating profit on team performance for the 1999-2004 period. Team performance is measured as a league position and percentage of points gained in both all and only league games during one season. Dummy variables for each sport-year are included in the regressions. *Operating revenue* and *Operating profit* are in British pounds and are from the Amadeus company database. *p*-values are presented in parentheses. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

	Operating revenue$_{i,t}$	*Operating profit*$_{i,t}$	*Operating revenue*$_{i,t}$	*Operating profit*$_{i,t}$	*Operating revenue*$_{i,t}$	*Operating profit*$_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	68,368,010	-2,573,438	-65,549,552	1,690,774	-49,081,252	1,948,532
	(0.000)***	(0.658)	(0.001)***	(0.887)	(0.005)***	(0.851)
League position$_{i,t}$	-1,359,464	-365,718				
	(0.047)**	(0.383)				
League position $_{i,t-1}$	-1,035,935	567,063				
	(0.104)	(0.148)				
% of max. points, all games$_{i,t}$,			85,229,363	-6,757,561		
			(0.006)***	(0.705)		
% of max. points, all games$_{i,t-1}$			100,719,046	3,109,889		
			(0.001)***	(0.863)		
% of max. points, league games$_{i,t}$					71,732,667	-5,921,814
					(0.011)**	(0.717)
% of max. points, league games$_{i,t-1}$					86,606,404	1,866,865
					(0.003)***	(0.911)
Sport-year 2000 dummy	1,443,776	-4,571,390	5,973,475	-4,587,322	5,519,888	-4,680,632
	(0.897)	(0.517)	(0.616)	(0.5210	(0.641)	(0.512)
Sport-year 2001 dummy	1,682,196	-7,918,039	9,109,124	-6,741,924	7,281,652	-6,684,115
	(0.881)	(0.262)	(0.441)	(0.337)	(0.538)	(0.343)
Sport-year 2002 dummy	5,625,068	-13,191,653	12,726,716	-12,771,895	9,886,798	-12,745,047
	(0.604)	(0.055)*	(0.263)	(0.062)*	(0.384)	(0.063)*
Sport-year 2003 dummy	15,483,302	-9,019,099	26,853,612	-10,314,537	24,210,980	-10,294,708
	(0.154)	(0.184)	(0.020)**	(0.131)	(0.036)**	(0.132)
Sport-year 2004 dummy	16,183,596	-8,075,237	25,996,154	-7,921,789	23,519,004	-7,950,986
	(0.136)	(0.238)	(0.026)**	(0.254)	(0.042)**	(0.251)
F	9.239	1.054	6.097	0.655	6.282	0.654
Significance F	(0.000)***	(0.398)	(0.000)***	(0.710)	(0.000)***	(0.710)
Number of teams	26	25	26	25	26	25
Observations	131	127	131	127	131	127
R^2	0.345	0.058	0.258	0.037	0.263	0.037

Similarly to all games, the relation between operating revenue and percentage of points gained in league games, both present and lagged, is positive and significant at the 0.01 level. The size of the impact of league game success to operating revenue is slightly smaller than that of all games. An increase of one percentage point in current points gained in league games is associated with a £0.72 million increase in operating revenue. For lagged points gained in league games, the corresponding figure is £0.87 million. The model fit for the league games is slightly better than that for all games. R^2 is 0.263 and the F-ratio from the ANOVA test is 6.282, which is significant at the 0.001 level. For both regression (3) and regression (5), two of the sport-year dummy variables, 2003 and 2004, are significant at the 0.05 level. For regression (3), the sport-year 2003 is associated with a £27 million increase in operating revenue and the sport-year 2004 with a £26 million increase. For regression (5), the figures are £24 million for both sport-years.

Regression analysis was conducted also for operating profit as the dependent variable and the above-mentioned independent variables. However, the relation between operating profit and any of the independent variables is not statistically significant. However, the sport-year 2002 dummy variable is statistically significant for all operating profit regressions at the 0.1 level and is associated with a £13 million decrease in operating profit for all three regressions. The best model fit is that of regression (2) with present and lagged league position as the independent variables, but R^2 is only 0.058 and the F-ratio from the ANOVA test is 1.054, which is not significant.

Appendix 2 shows the results of the regressions of operating revenue and operating profit on team performance for English and Scottish clubs, listed in the London Stock Exchange. For this subsample, the relations between operating profit and the independent variables are even more pronounced. Furthermore, the relation between operating revenue and the lagged league position variable is negative and statistically significant at the 0.05 level. An improvement on one place in the league position is attached to £1.36 million increase in the operating revenue the following year. Also, the model fit of regression between operating revenue and league position, present and lagged, is much better for the English and Scottish clubs than for the pooled regression, as R^2 is 0.614. Like in the pooled regression, there is no statistical significance between operating profit and the independent variables.

While the English and Scottish clubs show a support to the hypothesis that revenue and team performance are related, the regressions in which the remaining European teams, from Denmark, Germany, Italy, the Netherlands, and Portugal, are pooled, provide much weaker evidence. Appendix 3 shows that, for the subsample of clubs from other markets, of all the independent variables, only lagged percentage of points gained of maximum available points in all games and lagged percentage of points gained of maximum available points in league games are statistically significant, both at the 0.1 level. League position, lagged or present, does not have any statistical significance. The size of the coefficients is slightly greater than in the pooled model: an increase of one percentage point in lagged points gained in all games is associated with a £1.37 million increase in operating revenue. For lagged points gained in league games, the corresponding figure is £1.32 million. Results from the tests on the robustness of the results are presented in Appendix 4, showing further support for the findings presented above.

Since the results indicate that operating revenue is related to the playing performance while there is no such evidence for operating profit, it seems that while there may be an added impact on revenues from the gate and merchandising due to a better performance on field during the previous and/or current season, it might be achieved by spending more on player transfers and player salaries. Thus, better performance might lead to higher operating revenue, but to achieve the better performance, clubs, on average, might have to spend more. Whitney's (1993) findings suggest that in a pursue of a league championship, the market for star athletes in professional sports could be subject to 'destructive competition' – a situation of increasing costs and a competitive process which drives some participants from a market even though it is inefficient for them to leave.

The result that operating profit and playing performance are not related are similar to those of Szymanski and Kyupers (1999), who study the relation between profit and team performance by taking a sample of 760 cases of football clubs changing position and profits, both for the same year and lagged effect. They do not find a significant relation between profits and performance. They state that the absence of a powerful relation between changes in position and changes in profits is one of the most important regularities in the business of football. It implies that there is no simple formula that relates financial success to success on the pitch. (Szymanski and Kuypers, 1999, 29)

Also, in regards to relation between operating revenue and team performance, these results are consistent with Szymanski and Kyupers (1999). They find that clubs with higher average league positions tend to have higher revenues relative to their rivals. They state that teams which enjoy greater playing success tend to generate more income in several ways, but the fans are the key element, as they have been the main source of income for football clubs throughout most of their history. More successful teams are better at attracting fans and at maintaining their loyalty. A successful team will tend to attract greater attendance at matches played against any given rival, or played at any particular stage of any particular competition.

In recent years clubs have developed new sources of revenue, such as broadcasting rights, sponsorship, and merchandising, but they too are affected by the playing success of the clubs. Teams with better playing records are televised more frequently and receive a greater share of broadcast revenues. Corporate sponsors are more willing to pay more to be associated with successful teams and successful teams are able to sell more merchandise.

Brown and Hartzell (2001) find that the relation between lagged winning percentage and franchise value is positive and statistically significant as well as lagged winning percentage and operating income. They also find that changes in net basketball revenue and net basketball revenue per share for Boston Celtics LP are related to the lagged number of wins. In other words, their results show that successful (in terms of wins) sports franchises are profitable. Furthermore, winning increases franchise value.

The results from the empirical analysis give support to the hypothesis that revenue and team performance are positively related. However, profit and team performance are not related according to the analysis. In addition to Szymanski and Kyupers (1999) and Brown and Hartzell (2001), these findings are consistent with Simmons (1996), who asserts that league position, goals scored and promotion and relegation between the divisions are important determinants of attendance patterns and thus, gate revenues. However, Dobson and Goddard (1998) find more evidence of causality running from lagged revenue to current performance than of causality in the opposite direction, while the dependence of performance on revenue seems to be greater for the smaller clubs than for the larger.

7.2.2 Evidence on volume and volatility

This section provides the empirical results for the third hypothesis: *Returns and trading activity (e.g., volume and volatility) in the shares of the football clubs are related to team performance (i.e., game results).* To test whether returns and trading activity are related to team performance, I examine whether trading volume and volatility are different during the season and on trading days after games. Table 13 shows mean daily volume and daily volatility and the results from the nonparametric Mann-Whitney (U) tests. Mean volume is reported as number of shares traded per trading day. Mean daily return volatility is calculated by using the Parkinson (1980) extreme value method and the Garman-Klass (1980) 'Best' Analytic Scale-invariant Estimator.

Mean daily trading volume is higher during on-season and on trading days following games, and the difference between on-season and off-season trading volume is significant at the 0.001 level. Furthermore, at the same significance level, the average volume for days following games (697,208 shares) is higher than that of all other trading days (467,158 shares). Also, on-season trading days that do not follow a game have a lower mean trading volume (555,200 shares), and the difference in trading volume between trading days that follow and do not follow games is significant at the 0.001 level. Thus, volume evidence indicates that game results have an impact on trading. These findings are similar to those of Brown and Hartzell (2001).

Evidence from the volatility tests is different. Whereas comparing the daily return volatility for trading days following and not following games gives similar results as the volume tests, the mean daily return volatility is higher during off- than on-season, for both the Parkinson (1980) and the Garman-Klass (1980) (G-K) volatility measures. Using the Garman-Klass (1980) estimator, the annualized mean volatility for the sample is 25.57%. Using the Parkinson (1980) extreme value method, the annualized mean volatility for the sample is higher, 31.61%. The difference between on-season and off-season volatility is statistically significant at the 0.001 level. On a club-level analysis, nine out of thirty-two clubs reported higher on-season volatility, at least at the 0.1 level. In comparison, eleven clubs had a higher off-season volatility, statistically significant at least at the 0.1 level. Division between the London Stock Exchange listed clubs and others did not provide any statistically significant results. There does not seem to be a common nominator for the clubs, having either higher on- or off-season volatility.

However, the evidence from the trading days following games supports the hypothesis that games matter to investors. The mean volatility is higher on trading days following games (G-K 27.61%) compared to all other days (G-K 25.09%) and to on-season, no-game days (G-K 24.64%), and both differences are significant at the 0.001 level.

The volume tests support the hypothesis that the games matter to the investors, and there is an order to sizes. The smallest volume occurs on off-season days, followed by on-season days that do not follow a game, with the highest volume occurring during the season on days following the games. For volatility, there is not such clear ordering to support the hypothesis. The lowest volatility occurs on on-season trading days not following the game, followed by off-season volatility, with the highest volatility occurring during the season on days following the games.

If not taking into account the higher off-season volatility, both the volume and the volatility evidence is similar to the findings of Brown and Hartzell (2001), who find that volume and return volatility are statistically significantly higher during on-season than off-season, and on trading days following games than on trading days that do not. Thus, the empirical results provide support to the hypothesis that trading activity and games are related.

Table 13 Volume and volatility statistics

This table presents the mean daily trading volume and return volatility over the sample periods specified in Appendix 1 for the unit shares of the football clubs. Mean daily trading volume is presented in number of shares traded. *p*-values from Mann-Whitney (U) tests for the differences in these variables between on-season and off-season, and between the days that follow games and do not follow games are also presented. Volatilities calculated using the Parkinson (1980) extreme value method and the Garman-Klass (1980) 'Best' estimator are both reported.

	Mean	*p*-value
Daily trading volume	508,790	
On-season	588,646	on>off
Off-season	272,030	0.000
Game since last trading day	687,208	game>no game
No game since last trading day	467,158	0.000
Game since last trading day	687,208	game>no game
No game since last trading day (season only)	555,200	0.000
Daily return volatility (annualized) - Parkinson	31.61%	
On-season	31.51%	off>on
Off-season	31.93%	0.000
Game since last trading day	34.18%	game>no game
No game since last trading day	31.03%	0.000
Game since last trading day	34.18%	game>no game
No game since last trading day (season only)	30.64%	0.000
Daily return volatility (annualized) - Garman-Klass	25.57%	
On-season	25.37%	off>on
Off-season	26.26%	0.000
Game since last trading day	27.61%	game>no game
No game since last trading day	25.09%	0.000
Game since last trading day	27.61%	game>no game
No game since last trading day (season only)	24.64%	0.000

To understand the reasons for the higher off-season volatility, the data is looked more closely upon. If high volatilities occur in July, the reason could be player transfers; if in the end of May or in June, speculations on the player transfers could cause the high volatilities. The cause could also be earnings announcements taking place for most of the clubs in the end of May, June, or July. The highest volatilities in the sample data take place mostly in July, but also in May just after the season has finished.

An explanation for higher volatility during off-season could be, therefore, player transfers. The most important transfers in monetary as well as publicity terms take place in July and August. Speculation for transfers starts quite early. However, the transfer market is open also during January, but the biggest transfers in terms of cost are made in July and August. I believe that the evidence from player transfers would help to shed some light to this question.

7.2.3 Evidence from returns

This section presents the empirical findings for the fourth hypothesis: *Investors (and therefore returns) respond symmetrically to positive and negative (unexpected) team performance.* The results for the fifth hypothesis, *The market reacts more strongly to the unexpected outcome than to expected outcome,* are presented in the latter part of this section.

In addition to volume and volatility, games can affect returns. The results for testing the returns part of the third hypothesis and fourth hypothesis are presented in Table 14. To test the relation between returns and game outcomes, the clubs' daily returns are regressed on the local market index. The residuals from these regressions, labeled *Abnormal Return*, capture the return not explained by the market and the clubs' covariance with the market. Table 14 gives the mean abnormal returns for days following games, grouped by wins, draws, and losses, not taking into account the market expectations.

Table 14 Mean returns - unadjusted game outcome

This table details mean market-adjusted returns for the sample clubs over the August 1, 1998 to April 12, 2004 sample period. Post-game market-adjusted returns are grouped by game outcome, i.e. win, draw, and loss. Market-adjusted returns are defined as the residuals from a market-model regression of a football club's stock return on the local market index return. The number of games and p-values for two-tailed test comparing each mean against the null hypothesis of zero mean are presented below each value. Equivalent mean p-values for mean pairs are also noted below. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

		Unadjusted game outcome		
		Win	Draw	Loss
Mean post-game return		0.598%	-0.177%	-0.913%
Observations		3685	1927	2344
p-value: mean = 0		0.000***	0.016**	0.000***
Difference in mean			p-values	
	Win		0.000***	0.000***
	Draw			0.000***

In an efficient market, if shares are trading on financial performance and financial performance is based on playing performance, the expected game results should be incorporated into the price before the games take place. If a club wins, but the market expected them to, the game might have no new information. Therefore, there is no reason to expect a strong relation between game outcomes unadjusted for the expectations and changes in a club's share price.

The table shows that it is obvious that different outcomes lead to different average returns. Unadjusted wins (0.598%) yield on average positive returns and unadjusted losses negative returns. Unadjusted draws are somewhere in the middle of the two, and yield a negative return of -0.177%. The mean reaction to loss is the greatest of all in magnitude, -0.913%. According to the Student's *t*-test, the mean abnormal returns for both wins and losses differ statistically significantly from zero, at the 0.001 level. The mean return for draw differs also from zero and is statistically significant, at the 0.05 level.

The table gives also the *p*-values from the Student's *t*-test determining whether the win-draw, win-loss, and draw-loss return pairs differ significantly from each other. All the mean returns are statistically significantly different from each other, at the 0.001 level. An *F*-test of the null hypothesis that market reactions to wins and losses are symmetrical ($\mu_{win} + \mu_{loss} = 0$) reject the null at the 0.01 level.

The results shows evidence that investors respond asymmetrically to positive and negative team performance. Wins do result in a positive return and losses in a negative return, but the effect on returns is not equal in magnitude. Losses seem to be penalized more. Draws produce a negative return, which seems sensible, as a win gives three points to a team, a loss zero, and a draw one point. Apart from being different from zero statistically significantly, the returns differ from each other and the results are statistically significant at the 0.001 level.

Winning the game will result in a positive price change, regardless of the outcome versus the odds. In the same way, loss will yield a negative price change, independent of the outcome versus the betting market odds.

This part of the chapter provides the empirical results for the testing of the fifth hypothesis; *The market reacts more strongly to the unexpected outcome than to expected outcome.* To capture the market expectations, this study uses the betting-market fixed odds. The importance of actual outcomes versus ex ante expectations is analyzed by partitioning trading days into twelve groups based on the points the clubs are expected to get from a game, falling between zero and three points, and the actual outcome, i.e. win, draw, or loss. Table 15 gives the mean post-game returns by expected and realized outcome. *t*-statistics and *p*-values from the two-tailed Student's *t*-test are reported below each mean post-game return, as well as the number of observations in each group.

To follow the fifth hypothesis, that an unexpected outcome results in a more strong market reaction than the expected one, we would expect that in Table 15, for wins, the returns would decrease in from left to right, for draws, the smallest returns would be in the middle categories, and for losses, the returns would increase from left to right.

A win results in a positive average abnormal return, although the order for the sizes of the returns is not as presented in the hypothesis. Surprisingly, the highest return for win events, 0.747%, is in the 1.5 – 2.25 expected points group, not in the 0 – 0.75 expected points group, which is the most unexpected result group for wins. However, the draw returns vary from positive to negative and the ordering of the returns goes as hypothesized, as well as for the loss returns. All the significant loss returns are negative, and the highest negative return for a loss, -1.221% is in the 2.25 – 3 expected points group, where a win is expected but a loss takes place.

To test the fourth hypothesis for the unexpected outcome part - whether the market reaction is symmetrical for unexpected wins and losses - the *F*-test is conducted. The two groups, whose means are compared, are Win:Expected 0 – 0.75 points and Loss:Expected 2.25 – 3 points, as both are seen as the most unexpected outcomes. The *F*-test of the null hypothesis that market reactions to unexpected wins and losses are symmetrical ($\mu_{win,\ 0-0.75} + \mu_{loss,\ 2.25-3} = 0$) fails to reject the null at the 0.05 level. The same applies for less unexpected wins and losses (Win:Expected 2.25 – 3 points and Loss:Expected 0 – 0.75 points) (not reported).

Table 15 Mean returns and expected game outcome

This table presents mean market-adjusted returns for the sample clubs over the August 1, 1998 to April 12, 2004 sample period. Post-game market-adjusted returns are grouped by expected game outcome and realized game outcome. Expected game outcome is defined by points, which are calculated from the betting market fixed odds converted to probabilities and multiplied by outcome payoff (three points from a win, one point from a draw, and zero from a loss). Market-adjusted returns are defined as the residuals from a market-model regression of a football club's stock return on the local market index return. The number of games and *p*-values for two-tailed test comparing each mean against the null hypothesis of zero mean are presented below each value. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

	Expected result (points)			
Realized event	0 - 0.75	0.75 - 1.5	1.5 - 2.25	2.25 - 3
Win				
mean post-game return	0.434%	0.715%	0.747%	0.064%
t-statistic	0.88	6.10	9.92	0.43
p-value	0.385	0.000***	0.000***	0.671
Observations	64	990	1757	461
Draw				
mean post-game return	0.300%	0.134%	-0.521%	-1.329%
t-statistic	1.12	1.11	-5.26	-3.44
p-value	0.265	0.268	0.000***	0.001***
Observations	78	896	760	51
Loss				
mean post-game return	0.215%	-0.858%	-1.213%	-1.221%
t-statistic	0.87	-7.93	-7.70	-1.90
p-value	0.384	0.000***	0.000***	0.065*
Observations	241	1272	584	37

Table 16 presents the p-values from the difference-in means tests. The tests show that over half of the pairs are statistically significant, and that the differences between the expected outcomes and actual outcomes are significant. For example, the difference between the groups Win:Expected 1.5 – 2.25 points and Win:Expected 2.25 – 3 points is significant at the 0.001 level, as well as is the difference between the groups Win:Expected 1.5 – 2.25 points and Loss:Expected 1.5 – 2.25 points. These results offer support for the hypothesis that the stock market's expectations reflect the betting market expectations. Brown and Hartzell (2001) find only moderate support for the integration of betting market and stock market. If both markets have the same expectations, the unexpected win (loss) should show a greater (more negative) return than the expected win (loss). This is reflected in the returns for the realized events of draws and losses. If the win data were split into two expected point groups instead of four, this would also support the assumption that the unexpected result yields a higher return, 0.698%, than the expected, 0.605%. However, the return for an unexpected win is still not the same magnitude as the return for an unexpected loss. It seems that losses are penalized more severely than wins, as are unexpected draws if a win has been expected to take place.

There is no evident reason to expect a different market reaction (in magnitude) to good news as compared to bad news. If firm's cash flows are dependent on the team's performance on pitch, then if the team performs above the expectations, it should imply a higher present value of the cash flows. This should lead to higher stock prices and higher returns. Similarly, performing under expectations should lead to lower stock prices and lower returns. Datta and Dhillon (1993) show that bondholders react positively (negatively) to unexpected earnings increases (decreases). However, the findings of this study are consistent with Brown, Harlow, and Tinic (1988), who find evidence to the uncertain information hypothesis that following news of a dramatic financial event, both the risk and expected return of the affected companies increase systematically, and that prices react more strongly to bad news than good. Also, Camerer (1989) finds evidence that in assessing a team's outlook, bettors place different weights on winning and losing streaks and thus, they maintain that losing streaks are more likely to continue than winning streaks. Tables 15 and 16 show support to the hypothesis that investors respond differently to wins, draws, and losses, both the expected and unexpected ones. This is inconsistent with the study of Pearce and Roley (1983) who indicate that stock prices respond only to the unanticipated change in the money supply as predicted by the efficient market hypothesis.

To conclude this section, the empirical support to the third, fourth, and fifth hypothesis can be summarized as follows. Evidence is provided for the third hypothesis that returns are related to the team performance. Investors respond differently to wins, draws, and losses, and for unadjusted outcome the responses, i.e., mean returns, are asymmetric. Losses are penalized more than wins are rewarded, which would lead to the rejection of the fourth hypothesis that investor respond symmetrically to wins and losses. Also, for the expectation-adjusted outcomes, the market responses are different, meaning that there is an ordering in the returns according to the unexpectedness, wins produce positive, losses negative returns and draws both positive and negative, depending on the unexpectedness, which would support the fifth hypothesis, that investors react more strongly to unexpected than expected outcomes. The symmetry hypothesis cannot be rejected for the expectation-adjusted outcomes, which would support the fourth hypothesis.

Table 16 Difference in mean for mean post-game day returns conditioned on expectations and game outcome

This table details the *p*-values for the two-tailed tests comparing mean market-adjusted return pairs from the Table 15 against each other. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

p-values for differences in means

Outcome		Realized	Win			Draw				Loss				
		Expected	0.75-1.5	1.5-2.25	2.25-3	0-0.75	0.75-1.5	1.5-2.25	2.25-3	0-0.75	0.75-1.5	1.5-2.25	2.25-3	
Realized	Expected	Mean post-game return	0.715%	0.747%	0.064%	0.300%	0.134%	-0.521%	-1.329%	0.215%	-0.858%	-1.213%	-1.221%	Obs.
Win	0 - 0.75	0.434%	0.584	0.536	0.478	0.812	0.559	0.063*	0.006***	0.693	0.013**	0.002***	0.045**	64
	0.75 - 1.5	0.715%		0.822	0.001***	0.157	0.001***	0.000***	0.000***	0.067*	0.000***	0.000***	0.005***	990
	1.5 - 2.25	0.747%			0.000***	0.111	0.000***	0.000***	0.000***	0.040**	0.000***	0.000***	0.004***	1757
	2.25 - 3	0.064%				0.444	0.719	0.001***	0.001***	0.602	0.000***	0.000***	0.058*	461
Draw	0 - 0.75	0.300%					0.573	0.005***	0.001***	0.815	0.000***	0.000***	0.034**	78
	0.75 - 1.5	0.134%						0.000***	0.001***	0.768	0.000***	0.000***	0.045**	896
	1.5 - 2.25	-0.521%							0.048**	0.006***	0.022**	0.000***	0.288	760
	2.25 - 3	-1.329%								0.001***	0.246	0.784	0.887	51
Loss	0 - 0.75	0.215%									0.000***	0.000***	0.042**	241
	0.75 - 1.5	-0.858%										0.063*	0.580	1272
	1.5 - 2.25	-1.213%											0.991	584

These findings are similar to those of Brown and Hartzell (2001), who find that games contain value-relevant information that is used by investors and get mixed support for the symmetry hypothesis. However, in their study, there is no obvious change in estimated relation when point spreads are used to capture market expectations.

7.2.4 Which games matter?

This section provides the empirical findings from testing the sixth hypothesis: *The European competitions, national cups and relegation/promotion games have a more significant impact on returns than league games.* To determine if there is a difference between regular league games and cup games, i.e. whether different games have a different impact on the returns, a regression analysis is conducted with abnormal return as the dependent variable and unexpected outcome and the interaction variable of unexpected outcome and cup game dummy as the independent variables. Table 17 presents the results from the regression analysis.

Table 17 Regression results of market-adjusted returns on game result variables [dependent variable: Abnormal Return (in basis points)]

This table presents the results of OLS regressions on unexpected game outcome and cup games for the sample clubs for the sample period from August 1, 1998 to .April 12, 2004. *p*-values are shown below coefficients. *Unexpected Outcome* derived by subtracting the expected outcome from the realized point result. Expected outcome is calculated by using betting market probabilities for potential game outcomes and multiplying each probability by the point payout. *Abnormal Return* is defined as the residual (in basis points) from a market-model regression of the daily club's return on the local market index return. The *Cup Game Dummy* variable is equal to one when a cup game took place after the previous trading day and zero otherwise. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

	(1)	(2)
Constant	-0.051	-0.049
	(0.213)	(0.232)
Unexpected Outcome $Y_{i,t}$	0.573	0.528
	(0.000)***	(0.000)***
Unexpected Outcome $Y_{i,t}$ * *Cup Game Dummy*		0.346
		(0.001)***
Observations	7191	7191
Adjusted R^2	0.038	0.040

Both *Unexpected Outcome* and the interaction variable *Unexpected Outcome * Cup Game Dummy* are positive and significant at the 0.001 level. However, although they are significant, their impact on the dependent variable *Abnormal Return* is very small, as the slope for the unexpected outcome coefficient is only 0.528 and 0.346 for the cup game interaction variable. Both variables are very small in magnitude and represent the change in return for a one-point change in unexpected outcome, which will get only values between negative and positive three. For example, if a team wins a match it was expected to lose (with win/draw/loss probabilities of for example 0.1/0.3/0.6, producing expected points of 3*0.1 + 1*0.3 = 0.6 and unexpected outcome of 3 – 0.6 = 2.4), the model's impact on abnormal return is 0.528 * 2.4 = 1.267% and in case it is a cup game, additional 0.346 * 2.4 = 0.830%. If the team wins a match it was expected to win (with probabilities 0.6/0.3/0.1, producing expect points of 2.1 and unexpected outcome of 3 – 2.1 = 0.9), the expected effect on abnormal return is 0.528 * 0.9 = 0.475% and for a cup game, additional 0.346 * 0.9 = 0.311%. However, it is good to remember that the mean daily return for the sample clubs is only -0.092%, and compared to that the unexpected outcome impact and the cup game impact are not small.

The amount of variation in the outcome variable that is accounted for by the model fit is low. The adjusted R^2 is only 0.038 for the regression (1), slightly improving for cup game added regression (2), where it is 0.040. On the other hand, the *F*-ratios from the ANOVA are significant at the 0.001 level for both regressions (not presented in the table), thus the regression model results in significantly better prediction of abnormal return than if the mean value of abnormal return were used.

The evidence from the Table 17 suggests that the unexpected outcome and cup games have an impact on the abnormal returns, but the size of the impact seems to be small. As the cup game interaction variable is significant, these results support the hypothesis that unexpected outcomes from the cup games would have a stronger impact on the returns than the unexpected outcomes from the regular season games.

Another way of determining the importance of investor expectations is to regress returns by the expectation groups defined in Table 15. Each trading day after a game is put into one category based on the actual outcome of the game and the expected outcome. These categories result in 12 time series. Twelve additional series are created by multiplying each series by a dummy variable that is equal to one for a trading day after a cup game and zero otherwise as in regression (2) in Table 17. The results of these regressions are presented in Appendix 8.

The only significant results center for the categories where either 0.75 – 1.5 points or 1.5 – 2.25 points are expected, although this could be due to the bigger sample size for these categories. The highest positive abnormal returns that are significant are in regressions (3) and (4) or Win: E(points) 0.75 – 1.5, where a win with 0.75 points expected has an impact of 2.702% [(3 - 0.75) * 1.201)], or 2.707% [(3 - 0.75) * 1.203)] combined with the cup dummy, although the dummy variable is not significant. Moreover, the cup game variable is not significant for any of the realized win and draw regressions.

The most negative abnormal return that is significant is in regression (21) or Loss: E(points) 1.5 – 2.25, where an actual loss with 2.25 points expected has an impact of 2.252% [(0 – 2.225) * 1.001)]. For both Loss:E(points) 0.75 – 1.5 [regression (20)] and Loss:E(points) 1.5 – 2.25 [regression (22)] the cup game dummy negative and significant at the 0.001 level. Thus, this approach shows that only losses seem to matter in the cup games. This is contrary to the findings of Brown and Hartzell (2001), which show that for basketball, also wins seem to matter in the playoffs, although not in the regular-season. The slope coefficients and thus, abnormal returns seem symmetric for wins and losses, for the regressions that have significant variables.

In a summary of this analysis, the independent variables in the most unexpected and the most expected categories are not significant, which provides no clear support for the fifth hypothesis. Cup games are significant only for the actual loss categories, what offers mixed support for sixth hypothesis.

Since the results from the regressions for the actual and expected outcome categories show that only losses matter in cups, it is interesting to approach the hypothesis from a different perspective and pick out the actual events that will have an impact on the clubs' cash flows. Therefore, the games where a club drops out of domestic cups and international cups, and the games after which a promotion to a higher level division or avoiding a relegation to a lower division, and a relegation to a lower division or missing a promotion takes place are investigated more in detail next.

The premier leagues do not play playoffs, which are common in other sports, for example in basketball and ice hockey. However, in the English First Division (the Championship) the top clubs do play playoffs for the promotion to the Premiership. Thus, relegation and promotion could be comparable with playoffs. In some cases the exact timing of when the promotion or relegation is clear is difficult to determine. For example, a club's relegation may be obvious some weeks before the last game in the league takes place. It is difficult to pinpoint the exact date when the relegation or promotion is evident without an extensive background work for the dynamics of the league team performances. Therefore, on the trading day after the final game, for which the relegation event has been assigned, there might not be any significant abnormal return showing in the study.

Dropping out of cups will have a direct impact on the cash flows to the clubs. Furthermore, getting promoted to a higher division and being relegated to a lower division will also affect the revenues for a club in the future. Also, the event of avoiding a relegation can be seen as a positive signal for the club by the market, and the event of missing a promotion as a negative signal. To test whether these game matters, four regressions of market-adjusted returns on game result variables, promotion and relegation events, and elimination from domestic and international cups have been conducted. The model is much the same as for Dobson and Goddard (2001, 381-397). The results for these regressions are presented in Table 18.

The regressions encompass the full sample period. *Abnormal Return* is defined as the residual in basis points from a market-model regression of the daily club's return on the local market index return. The dummy variables are defined as equal to one when the event occurred between trading days t-k and t-k+1, for k = 1, 2, or 3, and zero elsewhere. The adjusted R^2 is 0.078 at its best. However, many of the independent variables are statistically significant.

As in the previous regression model in Table 17, the variable *Unexpected Outcome*, is significant and the size of the impact on the abnormal return is about the same, with the slope coefficient 0.544 in the last stepwise regression (4), which would have an effect of 1.627% [win with zero points expected (3 – 0) * 0.544)] at maximum or -1.627% [loss with three points expected (0 – 3) * 0.544)] at minimum. The *Relegation or Miss Promotion*$_{i,1,t}$ variable, which is for the first trading day after the game, has the biggest coefficient of all the variables, -15.603, and is significant at the 0.001 level. The second and third day variables for relegation or missing promotion are not statistically significant. Surprisingly, neither is the *Promotion or Avoid Relegation*$_{i,1,t}$ variable. Furthermore, the variables for the second day and third day after the event, *Promotion or Avoid Relegation*$_{i,2,t}$ and *Promotion or Avoid Relegation*$_{i,3,t}$, are negative and both are statistically significant at the 0.05 level.

Table 18 Regressions of market-adjusted returns on game result variables [dependent variable: Abnormal Return (in basis points)]

This table reports results of OLS regressions of market-adjusted returns on unexpected game outcome, promotion or avoiding relegation, relegation or failing to gain promotion, and domestic and international cup dummy variables. The regressions encompass the sample period from August 1, 1998 to April 12, 2004. *Abnormal Return* is defined as the residual (in basis points) from a market-model regression of the daily club's return on the local market index return. The dummy variables are defined as equal to one when the event occurred between trading days *t-k* and *t-k*+1, for k = 1, 2, or 3, and zero elsewhere. *p*-values are presented below coefficients in parentheses. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

	(1)	(2)	(3)	(4)
Constant	-0.096	-0.016	-0.017	-0.018
	(0.015)**	(0.695)	(0.678)	(0.674)
Unexpected Outcome $Y_{i,t}$	0.572	0.544	0.544	0.544
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Promotion / relegation				
Promotion/Avoid Relegation, $U_{i,1,t}$		0.475	0.476	0.477
		(0.570)	(0.569)	(0.568)
Promotion/Avoid Relegation, $U_{i,2,t}$			-1.680	-1.679
			(0.044)**	(0.045)**
Promotion/Avoid Relegation, $U_{i,3,t}$				-1.659
				(0.047)**
Relegation/Miss Promotion, $D_{i,1,t}$		-15.605	-15.603	-15.603
		(0.000)***	(0.000)***	(0.000)***
Relegation/Miss Promotion, $D_{i,2,t}$			1.391	1.392
			(0.106)	(0.106)
Relegation/Miss Promotion, $D_{i,3,t}$				-0.124
				(0.886)
Domestic cups / European competitions				
Domestic Cup Elimination, $F_{i,1,t}$		-0.500	-0.499	-0.498
		(0.020)**	(0.020)**	(0.021)**
Domestic Cup Elimination, $F_{i,2,t}$			0.061	0.061
			(0.777)	(0.775)
Domestic Cup Elimination, $F_{i,3,t}$				0.245
				(0.253)
European Competition Elimination, $E_{i,1,t}$		-2.596	-2.594	-2.596
		(0.000)***	(0.000)***	(0.000)***
European Competition Elimination, $E_{i,2,t}$			0.006	0.007
			(0.985)	(0.984)
European Competition Elimination, $E_{i,3,t}$				-0.309
				(0.380)
Observations	7191	7371	7720	8005
Adjusted R^2	0.034	0.078	0.078	0.078

Both domestic and international cup elimination variables for the first day after the elimination event are negative and statistically significant. The *Domestic Cup Elimination*$_{i,1,t}$ variable coefficient is -0.498 and statistically significant at the 0.05 level. The *European Competition Elimination*$_{i,1,t}$ variable is greater in size, -2.596 and significant at the 0.001 level. None of the second and third day variables for the cup elimination are statistically significant. The result that the cup eliminations have a significant impact on the following day's return is similar to the findings of Brown and Hartzell (2001), who find that the playoff effect is significant above and beyond the regular-season games and especially the impact of losses, which are driving the relation during the regular-season. Furthermore, also Dobson and Goddard (2001) find that elimination from either the FA Cup or from European competition tends to cause a significant negative price reaction.

The results of the regressions in Table 18 are similar to the findings of Dobson and Goddard (2001) in the respect that unexpected outcome, relegation-related events, and dropping from domestic and international cups have a significant impact on the returns, and furthermore, for the first mentioned, the effect is positive and for the three latter, the effect is negative. However, the first post-game day reaction to promotion in this study is insignificant, with significant and negative reaction during the next two days, while Dobson and Goddard (2001) find a significant positive reaction for promotion-related events the first post-game day and negative but insignificant reactions during the next four days.

Tests for assessing the assumption of no multicollinearity were also conducted. The variance inflation factor (VIF)[7] and tolerance statistics were calculated. All the VIF values were barely above one, therefore it can be safely concluded that there is no collinearity within the regression data. Furthermore, the average VIF is very close to one and this confirms that collinearity is not a problem for this data (Field, 2005, 196).

The results from the analyses in this section provide support for the hypothesis that European competitions, national cups and relegation games have a more significant impact on the returns than league games. However, there is no evidence in the analysis that promotion would have a positive effect on the returns.

[7] Variance inflation factor (VIF) is a measure of multicollinearity. The VIF indicates whether a predictor has a strong linear relationship with the other predictor(s). Myers (1990) suggests that a value of 10 is a value to be concerned about. Bowerman and O'Connell (1990) suggest that if the average VIF is greater than 1, then multicollinearity may be biasing the regression model. (Field, 2005, 748)

7.3 Timeliness of information effects

Since games occur exclusively when the market is closed, analyzing the listed football clubs provides insight as to when publicly available information is embedded into stock prices. This subchapter tests the seventh hypothesis, which is related to this timeliness of information effects: *If there is a private component to game-related information, it will not affect prices until after the market has opened.* To test this hypothesis, two volatility series using daily opening and closing price are constructed. Following Brown and Hartzell (2001), closed-market volatility is defined as the absolute percentage price change form the previous day's close to the open. Open-market volatility is defined as the absolute percentage price change from the open to the close. The figures are annualized by multiplying them by the square root of 510 since there are on average this many total open- and closed-market periods each year during the sample.

The results of the analysis for are presented in Table 19. Panel A of Table 19 shows the median closed- and open-market volatilities for the period from August 1, 1998 through April 14, 2004. A Mann-Whitney (U) test for differences between open- and closed-market volatilities rejects the null hypothesis of no difference at the 0.001 level. Partitioning the sample into post-game days and all other days yields similar results. The last row of Panel A compares sub-period volatilities for post-game trading days and all other days. Both closed-market and open-market volatilities are significantly higher for post-game trading days than all other days. If the price-relevant information in games is a mainly objective (or public) assessment of future cash flows, the price should change during the closed-market period and open with a new equilibrium price. If the price-relevant information is subjectively evaluated (or privately), then the price changes as the investors trade on it, which they can do only when the market is open. (Brown and Hartzell, 2001, 354) The significantly higher closed-market volatility for post-game trading days suggests that there is a public information component in the price, which causes the price adjust before the opening. This offers support to the hypothesis that the timing of public information leads to the difference between open- and closed-market volatilities. However, the higher open-market volatility for post-game trading days suggests that, in support of the hypothesis, games cause investors to revise their private beliefs about the firm. These revisions lead to increased volatility the following day, as the private information is incorporated into prices after the market opens. The difference in medians between open-market volatility and closed-market volatility for game periods is slightly less than the same difference when no game is played, and open-market volatility is significantly greater than closed-market volatility at the 0.001 level. If public, rather than private, information were driving the difference in volatility, the one would expect this gap to narrow for game periods (Brown and Hartzell, 2001).

Table 19 Closed-market and open-market price volatility

This table presents the median price volatility for the sample clubs for times when the market is closed and open. The sample is broken into two groups based on whether a game was played since the last trading day. Volatilities for closed- and open-market periods are calculated from closing and opening prices. *p*-values for Mann-Whitney (U) tests for the differences between closed-market and open-market volatility, and between volatility for the periods that follow games, and do not follow games are also presented. Panel A shows results for the sample period August 1, 1998 to April 14, 2004. Panel B compares volatilities based on game outcome for the sample period. In addition to presenting the median volatility, the volatility for each subgroup is compared to the volatility when the market was closed or open, and no game was played. The asterisks represent significance of tests of equal volatility over these periods compared to all periods when the market is closed and no games are played. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. These data are from Thompson Datastream database.

Panel A: Median price volatility, annualized

Median price volatility (annualized)	Number of observations	Closed-market	Open-market	*p*-value Open>Closed
All clubs				
All trading days	32465	25.37%	32.10%	0.000***
No game since last trading day	26286	25.09%	31.81%	0.000***
Game since last trading day	6179	28.23%	34.74%	0.000***
p-value : game > no game		0.000***	0.011**	

Panel B: Median price volatility by game outcome, annualized

Market sub-period	Win	Draw	Loss	No game
Closed-market	26.57%	26.89%	33.09%	25.09%
Open-market	33.61%	30.93%	39.45%	31.81%
p-value : open > closed	0.000***	0.036**	0.004***	0.000***
Observations	2935	1472	1772	26286
p-values : equal volatility to no game period				
p-value : game>no game (closed-market)	0.013**	0.056**	0.000***	
p-value : game no game (open-market)	0.107	0.773	0.001***	
		no game > draw		

Panel B of Table 19 presents the analysis of open-market and closed market volatilities by actual game outcome. Open-market volatility is significantly higher than closed-market volatility for each game outcome. Regardless of game outcome, closed-market volatilities are always higher when games are played than non-game periods. This suggests that the public information in the game results causes the prices to be adjusted to a new equilibrium at open.

However, in the case of open-market volatilities, the only significant, and significantly higher, volatility for game periods versus non-game periods is when there is a loss. This would imply that the investors will revise their beliefs of the club and incorporate their subjective revisions into stock prices only if a loss has occurred.

To further investigate whether the investors' reaction to the unexpected game outcomes differs from the expected ones, the volatilities are further broken down to 12 categories as in Table 15. Table 20 presents the results of the analysis of the open-market and closed-market volatilities by expected and actual game outcome.

For realized win events, the open-market volatility is significantly higher than the closed-market volatility for all expected outcome categories, except the most unexpected outcome, i.e. when a loss is mostly expected (0 – 0.75 points), but the closed-market volatility for this category is not significantly higher than the open-market. Both open- and closed-market volatilities are the higher the more unexpected the outcome is, that is, the volatilities grow from right to left in the realized win categories. The closed-market volatility is significantly higher when games are played than no games are played for all other realized win categories, except the expected win category (2.25 – 3 points). The open-market volatility is significantly higher for post-game days than for trading days after which no games are played only for the expected draw category (0.75 – 1.5 points).

For realized draws, none of the expected points categories has a significantly higher open-market volatility than closed-market volatility. The closed-market volatility is significantly higher when games are played than no games are played for the expected draw category (0.75 – 1.5 points), which means the least unexpected outcome, and the expected win category (2.25 – 3 points). The open-market volatility is significantly higher for post-game days than for trading days after which no games are played only for the expected loss category (0 - 0.75 points).

Table 20 Closed-market and open-market price volatility by expected and actual game outcome

This table presents median volatilities based on expected and actual game outcomes for the sample period of August 1, 1998 to April 14, 2004. For example, the (upper-left) closed-market-win (0-0.75) cell presents median volatility for times when the market is closed and the club was mainly expected to lose but won. Volatilities for closed- and open-market periods are calculated from closing and opening prices. *p*-values for Mann-Whitney (U) tests for the differences between closed-market and open-market volatility, and between volatility for the periods that follow games, and do not follow games are also presented. The asterisks represent significance of tests of equal volatility over these periods compared to all periods when the market is closed and no games are played. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. These data are from Thompson Datastream database.

Median volatility by expected and actual game outcome, annualized	Expected result (points)					
Realized event	0 - 0.75	0.75 - 1.5	1.5 - 2.25	2.25 - 3	Game	No game
Win						
Closed-market	57.18%	33.96%	26.88%	23.31%	29.52%	25.09%
Open-market	49.05%	38.94%	33.46%	31.01%	35.47%	31.81%
p-value : open > closed	0.544	0.024**	0.001***	0.018**	0.000***	0.000***
	closed > open					
p-value : game > no game (closed-market)	0.012**	0.002***	0.039**	0.801	0.000***	
				no game > game		
p-value : game > no game (open-market)	0.416	0.005***	0.171	0.705	0.000***	
				no game > game		
Observations	34	755	1405	400	5543	26286
Draw						
Closed-market	24.79%	28.45%	27.71%	48.83%		
Open-market	60.27%	33.96%	27.71%	29.30%		
p-value : open > closed	0.140	0.169	0.466	0.372		
				closed > open		
p-value : game > no game (closed-market)	0.800	0.062*	0.339	0.053*		
p-value : game > no game (open-market)	0.042**	0.593	0.152	0.717		
			no game > game	no game > game		
Observations	58	679	564	48		
Loss						
Closed-market	42.34%	34.22%	34.22%	26.90%		
Open-market	43.71%	41.69%	38.28%	22.36%		
p-value : open > closed	0.590	0.050**	0.128	0.857		
				closed > open		
p-value : game > no game (closed-market)	0.003***	0.000***	0.091*	0.296		
p-value : game > no game (open-market)	0.059*	0.003***	0.282	0.969		
				no game > game		
Observations	185	954	433	28		

When the actual outcome is a loss, the open-market volatility is significantly higher than closed-market only for the expected draw category (0.75 – 1.5 points). For losses, surprisingly, the volatilities are the smaller the more unexpected the result is. The closed-market volatility is significantly higher when games are played than no games are played for all categories, except the expected win category (2.25 – 3 points). The open-market volatility is significantly higher for post-game days than for trading days after which no games are played only for the least unexpected events (0 – 0.75 points and 0.75 – 1.5 points).

All in all, the findings of the Table 20 could be summarized as follows. The results from the most unexpected outcome categories are not significant for wins and losses. However, the ordering in the size of volatilities in terms of unexpectedness is different: for wins, the volatility is the higher, and for losses the lower, the more unexpected is the result. When comparing the volatilities for periods with game and no game, there does not seem to be a common pattern among the actual outcomes: the difference is significant for wins only for the expected categories in the middle, for actual losses the difference is significant for all categories, except when a win is expected, and for draws, no clear pattern exists at all.

To examine whether the results from different stock markets differ, the sample is split to two subsamples. The clubs from England and Scotland are in one sample and the clubs from Germany, Italy, the Netherlands, and Portugal in the other. The results of these analyses are in Appendices 9, 10, 11, and 12. Comparing results from appendices 9 and 11, some differences can be spotted.

In England and Scotland, it seems that the investors trade mainly on the private information, since the open-market volatility is higher than closed-market volatility is all significant results. Furthermore, of the actual outcomes, where the open-market volatility is higher for game periods than for no-game periods is when the news from the game is bad, i.e. loss. For expected wins, the volatilities are lower for than in no-game periods, whereas when the win is (mostly) unexpected, the volatilities are higher than in no-game periods. Also, for (mostly) expected losses, the volatilities are higher than in no-game periods. Unexpected losses do not seem to cause higher volatility. For wins, there is an ordering, so that the more unexpected the outcome is, the higher the volatility. For losses, the order is, interestingly, reverse.

In other markets in relation to games, investors seem to be trading more on public information since the closed-market volatility is higher than open-market volatility for all significant results, except for an expected win. Furthermore, both open-market and closed-market volatilities for all significant game outcomes, regardless of unexpectedness, are higher than for no-game periods. There is no ordering for volatilities based on the unexpectedness for any of the actual outcomes.

The results from the analyses of this section provide some support to the hypothesis that the private component of game-related information affects prices after the market has opened. For the full sample, as the open-market volatility is higher for trading periods directly following games, which suggests that games cause investors to revise their private beliefs about the firm and incorporate this in the prices the next day. Median closed-market volatility for periods that include games is significantly higher than closed-market volatility of no-game periods, which offers support for the hypothesis that the timing of public information leads to the difference between open- and closed-market volatility. The difference in medians between open-market volatility and closed-market volatility is slightly less than the same difference when no game is played, and open-market volatility is significantly greater than closed-market volatility at the 0.001 level. If public, rather than private, information were driving the difference in volatility, then one would expect this gap to narrow for game periods. Regardless of game outcome, open-market volatility is always significantly higher. Comparing the groups by actual and expected outcome, for significant results, both closed-market volatility and open-market volatility are always higher when games are played than when games are not played. However, unexpected losses do not result in significantly higher volatility on trading days following these outcomes, and for unexpected wins, only closed-market volatility is significantly higher than when no game is played.

These results support the hypothesis that investors are acting on private information after the market has opened, but do not provide much additional evidence in support of the earlier hypothesis that it is the unexpected outcomes that should matter the most. The conclusions are to a degree consistent with Brown and Hartzell (2001), Chang, Jain and Locke (1995), and French and Roll (1986) that high trading-time volatility is caused by private information that can only be acted upon when markets are open.

Differences for markets are clear. For other markets the closed-market volatility is higher than open-market volatility when games are played, while for the European and Scottish clubs the opposite is true. This means that for other markets the investors are trading on the public information. The conclusions for the other European clubs are consistent with Ederington and Lee (1993), Stoll and Whaley (1990), and Harvey and Huang (1991) that public information released when the market is open is primarily responsible for higher open-market volatility. Also these findings are similar to Jones, Kaul, and Lipson's (1994), who provide evidence that public (versus private) information is the major source of short-term return volatility.

7.4 Non-game event – managerial changes

While the analysis provided in the previous chapters addresses the effect of the games on the clubs trading activity and returns, there are many potentially interesting events that can also explain the trading patterns of the stocks of football clubs. For the remaining analysis sections, one of the important events, managerial changes, are studied more in detail. The first section examines the relation between team playing performance and managerial turnover, and the latter section concentrates on the effect of managerial changes on abnormal returns.

7.4.1 The relation between playing performance and managerial change

This section presents the results for testing the eighth hypothesis: *Managerial change and team performance are negatively related.* To test this hypothesis, regression analysis is conducted. Table 21 shows results on OLS regressions of managerial duration on team performance for the sample period of March 2, 1998 to October 21, 2005. Managerial duration is measured as the number of all games played during the spell. Team performance is measured as the percentage of points gained of maximum available points in all games and in league games for the whole spell and the current season, the percentage of points gained of maximum available points in cup games for the whole spell, and the percentage of points gained of maximum available points in all games and league games from one to six games, from seven to 12 games, from 13 to 18 games before termination.

Out of all independent variables, the most significant is the percentage of points gained of maximum available points in league games during the whole spell [regression (4)], which is significant at the 0.05 level. Ten percentage point increase in points gained results in 12 more games for managerial spell. Adjusted R^2 for the regression is 0.047. Adding the percentage of points gained of maximum available points in cup games during the whole spell to the regression [regression (5)] improves the significance and increases the size of points gained in league games for the whole spell. Ten percentage point increase in points gained yields 16 more games for managerial spell. The variable is significant at the 0.01 level. However, the cup game variable is not significant, but the adjusted R^2 is the highest of the nine regressions, 0.09.

The second highest variable by the significance is the percentage of points gained of maximum available points in all games during the whole spell [regression (1)], with the coefficient of 106.745, which is significant at the 0.1 level. This means that a ten percentage point increase in points gained from all games would result in 11 more games for managerial spell. The adjusted R^2 for the regression is 0.027. Adding the percentage of points gained of maximum available points in cup games during the whole spell to the regression [regression (2)] improves the significance and increases the size of the coefficient for points gained in all games for the whole spell. Ten percentage point increase in points gained yields 18 more games for managerial spell. The variable is significant at the 0.05 level. As in regression (5), the cup game variable is not significant, but the adjusted R^2 is slightly better, 0.064. For other regressions, none of the independent variables are significant, and the adjusted R^2 are even lower. Furthermore, F-ratios are not significant.

Changing the duration of spell into a natural logarithm (Table 22) causes the independent variables in simple regressions to lose their significance, lower F-ratios and R^2s. The best of the regression model is regression (5), with the percentage of points gained of maximum available points in league games during the whole spell and the percentage of points gained of maximum available points in cup games during the whole spell as independent variables. Points gained from league games has a coefficient of 1.879 and is statistically significant at the 0.05 level. As above, points gained in cup games is not statistically significant. The adjusted R^2 for the regression is 0.052.

The second best regression model by the significance is regression (2), with the percentage of points gained of maximum available points in all games during the whole spell and the percentage of points gained of maximum available points in cup games during the whole spell to the regression as independent variables. Points gained from all games has a coefficient of

1.778, which is significant at the 0.1 level. The variable points gained from cup games is not significant. The adjusted R^2 for the regression is 0.019. None of the independent variables is statistically significant alone in a regression.

Changing the independent variable slightly and using such a win ratio that win gives one point, draw 0.5 points and loss zero points, as in Dawson et al. (2000), all points are summed up and divided by the number of games played, yields similar but weaker kind of results: the independent variables and F-ratios are not as significant and adjusted R^2s are smaller (not reported). Multicollinearity between points gained in all games and cup games is a problem. Cup game points have been already included in previous variable. The correlation between these two independent variables is 0.47.

The results of the analysis are not as strong as expected, but they provide some support to the hypothesis that managerial tenure and team performance are positively related. These findings are not consistent with the finding of Audas, Dobson, and Goddard's (1999) that short-term fluctuations in performance strongly influence the involuntary termination hazard, as the analysis in this study provides significant results only for the variables encompassing the whole managerial spell. However, their finding that the involuntary termination hazard is dependent on the win ratio over the entire spell is more consistent with the findings of this study. Also the results derived by Scully (1994) shows by analyzing baseball, basketball and American football that managerial tenure is linked to the ability of the coach to extract the largest win percent from a given set of player inputs seem in line with this study

Also, the findings of this study are similar to a degree to e.g. Warner et al. (1988), Kang and Shivdasani (1995), and Dahya et al. (1998), who find a strong relation between poor firm performance and the probability that the top management of these firms will be forced to leave prematurely.

Table 21 Managerial change and team performance

This table presents the results from the OLS regressions. The dependent variable is *Duration of spell*, the number of all games played during the managerial spell.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	16.703	4.919	75.387	12.892	1.646	65.343	66.791	42.369	45.09
	(0.595)	(0.881)	(0.002)***	(0.642)	(0.958)	(0.004)***	(0.003)***	(0.111)	(0.092)*
% of max. points, all games, whole spell	106.745	178.225							
	(0.084)*	(0.017)**							
% of max. points, all games, current season			-11.759						
			(0.807)						
% of max. points, league games, whole spell				116.603	164.317				
				(0.035)**	(0.006)***				
% of max. points, league games, current season						10.066			
						(0.223)			
% of max. points, cup games, whole spell		-27.732			-4.593		22.134		
		(0.519)			(0.905)		(0.573)		
% of max. points, 13-18 league games before termination								40.159	
								(0.391)	
% of max. points, 7-12 league games before termination								57.466	
								(0.185)	
% of max. points, 1-6 league games before termination								1.03	
								(0.983)	
% of max. points, 13-18 games (all) before termination									29.271
									(0.477)
% of max. points, 7-12 games (all) before termination									52.073
									(0.274)
% of max. points, 1-6 games (all) before termination									10.174
									(0.837)
F	3.075	3.206	0.06	4.615	4.198	0.05	0.321	1.296	0.988
Significance F	(0.084)*	(0.047)**	(0.807)	(0.035)**	(0.019)**	(0.824)	(0.573)	(0.285)	(0.405)
Number of observations	75	66	75	75	66	75	66	58	60
Adjusted R^2	0.027	0.064	-0.013	0.047	0.090	-0.013	-0.011	0.015	-0.001
R^2	0.040	0.092	0.008	0.059	0.118	0.001	0.005	0.067	0.05

Table 22 Managerial changes and team performance, logarithmic dependent variable

This table presents the results from the OLS regressions. The dependent variable is *Duration of spell*, which is a natural logarithm of all games played during the managerial spell.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	3.688	3.489	4.244	3.440	3.361	4.028	4.106	3.770	3.788
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
% of max. points, all games, whole spell	0.180	1.778							
	(0.854)	(0.084)*							
% of max. points, all games, current season			-1.001						
			(0.182)						
% of max. points, league games, whole spell				0.690	1.879				
				(0.433)	(0.023)**				
% of max. points, league games, current season						-0.552			
						(0.436)			
% of max. points, cup games, whole spell		-0.721			-0.53		-0.224		
		(0.232)			(0.325)		(0.677)		
% of max. points, 13-18 league games before termination								0.189	
								(0.714)	
% of max. points, 7-12 league games before termination								0.655	
								(0.172)	
% of max. points, 1-6 league games before termination								0.149	
								(0.785)	
% of max. points, 13-18 games (all) before termination									0.272
									(0.585)
% of max. points, 7-12 games (all) before termination									0.447
									(0.413)
% of max. points, 1-6 games (all) before termination									0.151
									(0.790)
F	0.034	1.629	1.816	0.623	2.790	0.614	0.175	1.041	0.637
Significance F	(0.854)	(0.204)	(0.182)	(0.433)	(0.069)*	(0.436)	(0.677)	(0.382)	(0.594)
Number of observations	75	66	75	75	66	75	66	58	60
Adjusted R^2	-0.013	0.019	0.011	-0.005	0.052	-0.005	-0.013	0.002	-0.019
R^2	0.000	0.049	0.024	0.008	0.081	0.008	0.003	0.055	0.033

7.4.2 Managerial changes and cumulative abnormal returns

This section tests the ninth and the last hypothesis of the study: *Managerial changes manifest as abnormal returns.* Table 23 presents the cumulative and abnormal returns around the announcement day for the sample of 79 cases. The returns at the event itself are insignificantly positive. On day -1 the average abnormal return is -0.72% (median = 0.07%) with a *t*-statistic of -2.13. The average abnormal return for day 0 is 0.47% (median = 0.08%) with a *t*-statistic of 1.40. For day +1, the average abnormal return is 0.12% (median = 0.13%). The insignificant event-day return is similar to the ones reported by Reinganum (1985), Warner, Watts, and Wruck (1988), and Mahajan and Lummer (1988) and inconsistent with the significantly positive of Bonnier and Bruner (1989), Furtado and Rozeff (1987), and Weisbach (1987) and the negative returns of Beatty and Zajac (1987). Out of the 101 days of abnormal returns, only on eight days there are significant abnormal returns. Two of them are pre-announcements, on days -7 and -5, and the rest post-announcement, on days +11, +15, +32, +33, +41, and +45. Furthermore, none of the cumulative abnormal returns presented are statistically significant.

As the significant abnormal returns during the event window are so few, the findings could be seen as consistent with Warner et al. (1988), who report an insignificant excess return over the 60 days preceding the announcement. Also, Warner et al. find a significant association between poor performance and the frequency of management turnover, but no significant excess returns to shareholders at the announcement of management change. Also consistent with these results, Dahya (2000) finds that the share price response to the appointment or departure of a senior executive is small and statistically insignificant.

Table 24 summarizes the abnormal returns over different time intervals around the announcement date for the sample of clubs that announced a managerial change. The only significant cumulative abnormal returns are in the ten-day windows (+11, +20) and (+21, +30). To understand whether this is stock market's appreciation of the managerial change in relation to improved playing performance, managerial changes and succession performance should be further investigated., which is not included in the scope of this thesis. Also, Audas et al. (1997) find a harmful effect of managerial change to immediate team performance. None of the windows close to the announcement date are significant.

Table 23 Average and cumulative abnormal returns

The table presents average (*AR*) and cumulative average (*CAR*) abnormal returns over selected intervals for a sample of 24 clubs that announced a managerial change during August 1998 – March 2004, making 75 managerial changes over this period. Daily abnormal returns are calculated as standard market model residuals. Daily average abnormal returns are cumulated over a period from 50 days before the announcement to 50 days after. Both, abnormal returns and cumulative abnormal returns, are calculated each day in the event window. The parameters of the market model are estimated from 40 weeks of weekly data outside the event window. Returns on the local indices are used as a proxy for the market returns. Day is relative to managerial change announcement date. A two-tailed *t*-test is used to test the statistical significance. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. The managerial change announcement dates are identified from The Internet Soccer Database (www.soccerbase.com), the Association of Football Statisticians' homepages and the club's homepages.

Day	*AR*	*AR* *t*-statistic	*CAR*	*CAR* *t*-statistic	Day	*AR*	*AR* *t*-statistic	*CAR*	*CAR* *t*-statistic
-50	0.0003	0.08	0.0003	0.08					
-40	-0.0004	-0.13	0.0013	0.11	1	0.0012	0.36	-0.0033	-0.14
-30	-0.0041	-1.21	0.0096	0.63	2	0.0029	0.87	-0.0004	-0.02
-20	-0.0038	-1.13	-0.0004	-0.02	3	-0.0039	-1.16	-0.0043	-0.17
-10	-0.0037	-1.11	-0.0096	-0.44	4	0.0007	0.2	-0.0036	-0.15
-9	0.0002	0.06	-0.0094	-0.43	5	0.0046	1.37	0.001	0.04
-8	0.0044	1.29	-0.005	-0.23	6	0.0003	0.1	0.0013	0.05
-7	-0.0070**	-2.08	-0.012	-0.54	7	-0.0032	-0.95	-0.0019	-0.07
-6	0.0051	1.51	-0.007	-0.31	8	0.0036	1.07	0.0017	0.07
-5	0.0093***	2.78	0.0024	0.1	9	-0.0072**	-2.13	-0.0054	-0.21
-4	-0.004	-1.18	-0.0016	-0.07	10	-0.0028	-0.82	-0.0082	-0.31
-3	0.0004	0.13	-0.0011	-0.05	20	-0.003	-0.89	0.0156	0.55
-2	-0.001	-0.28	-0.0021	-0.09	30	0.0046	1.37	-0.0026	-0.09
-1	-0.0072**	-2.14	-0.0093	-0.39	40	-0.0015	-0.44	0.0024	0.07
0	0.0047	1.4	-0.0046	-0.19	50	0.0008	0.25	-0.0084	-0.25

Table 24 Cumulative abnormal returns over selected intervals

Cumulative abnormal returns over selected intervals for a sample of 24 football clubs and 75 management changes announced during August 1998 to March 2004. The announcements of managerial changes are identified from the Internet Soccer Base, the Association of Football Statisticians' home pages, and the clubs' home pages. Abnormal returns are calculated using the market model parameters estimated over a 200-day period ending 51 days prior to the announcement date. Local market indices obtained from Datastream are used to compute betas. The abnormal returns are cumulated in the intervals. A two-tailed test is used to test the statistical significance. The percentage positive is calculated as the number of observations with positive cumulative abnormal returns divided by the total number of observations. One, two, and three asterisks indicate significance at the 0.1, 0.05, and 0.01 level, respectively.

Interval	CAR %	*t*-statistic	Median %	% positive	Min	Max
-50 to -41	0.17	0.16	-0.09	48.1	-24.54%	20.77%
-40 to -31	1.20	1.13	1.25	55.7	-74.89%	59.28%
-30 to -21	-1.03	-0.97	-0.25	48.1	-23.55%	17.62%
-20 to -11	-0.92	-0.86	-1.23	39.2	-33.29%	62.70%
-10 to -6	-0.11	-0.15	-0.45	45.6	-26.60%	35.55%
-5 to -1	-0.23	-0.31	-0.13	49.4	-22.33%	17.74%
-1 to 0	-0.25	-0.52	-0.12	48.1	-12.57%	12.96%
0	0.47	1.40	0.08	57.0	-11.60%	19.41%
-1 to +1	-0.13	-0.22	0.04	51.9	-14.82%	10.60%
+1 to +5	0.55	0.74	0.20	51.9	-19.09%	28.66%
+6 to +10	-0.92	-1.22	0.05	53.2	-26.42%	12.83%
+11 to +20	2.37**	2.23	0.77	54.4	-13.09%	39.33%
+21 to +30	-1.81*	-1.71	-1.11	46.2	-20.31%	15.07%
+31 to +40	0.49	0.46	0.09	50.0	-30.33%	38.80%
+41 to +50	-1.08	-1.01	-0.32	42.9	-37.94%	31.94%
-50 to +50	-0.84	-0.25	4.30	55.7	-77.49%	55.30%

Figure 1 plots AR and CAR for the whole sample. The cumulative abnormal return is mostly positive up till the day -12, when it turns into negative. The negative downswing stays, with the exception of day -5's significant positive return, over the announcement day, till day +5. The actual upswing starts at day +15.

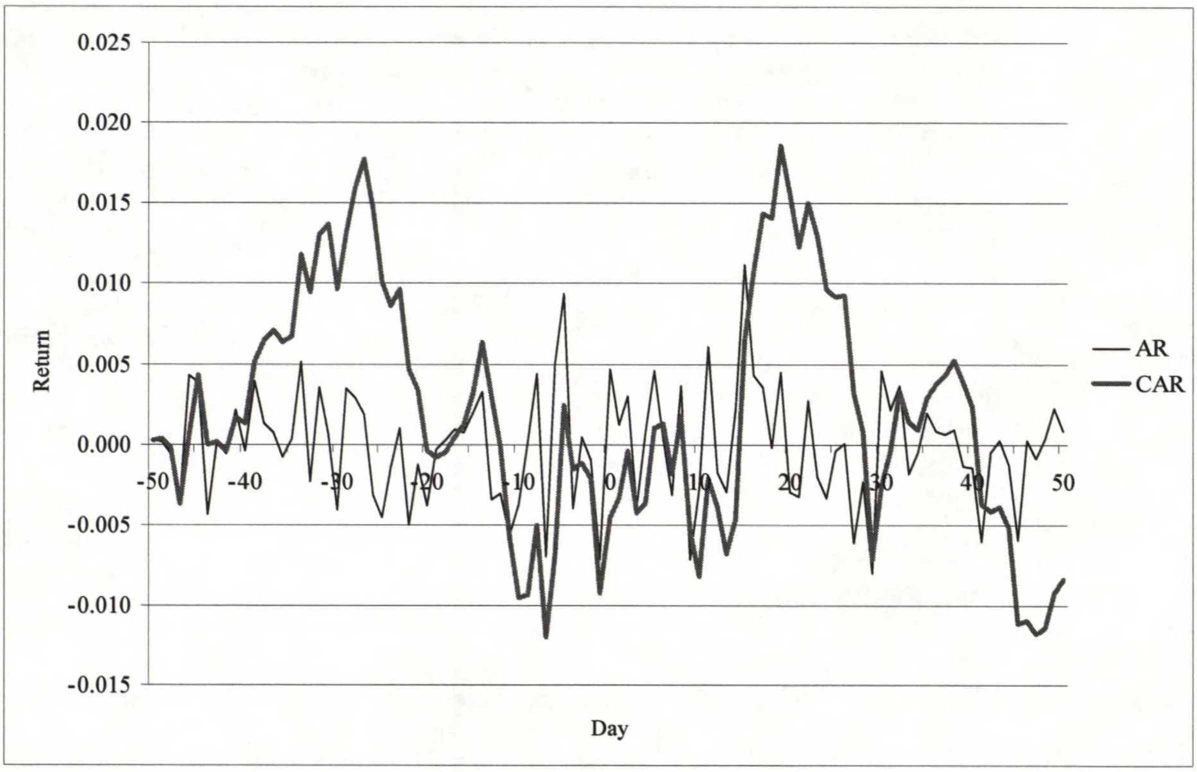
The weak responses to management changes are inconsistent also with the findings of Brown and Hartzell (2001), who find a very large response in stock prices to the hiring of a new Celtics' head coach, even more so that for building of a new arena, for which the cash flow implications should be much more clear.

The lack of strong evidence for the managerial changes manifesting as abnormal returns could be due to not partitioning the sample into voluntary and involuntary terminations and contracts ending. Furthermore, Furtado and Karan (1990) summarize that several studies report insignificant aggregate price effects for the overall sample, but significant positive or negative effects for specific types of changes, as for example in the studies by Warner et al. (1988) and Mahajan and Lummer (1993), who find no significant results for the total sample. However, for this study, this would likely make the sample size very small.

Another reason for the lack of finding a reaction in the share prices for managerial change announcements can be that the market perceives the leaving managers to possess general human capital, as defined by Becker (1964). General human capital is costlessly substitutable and occurs when contract costs are zero or when the replacing manager has similar managerial skills. Furtado and Karan (1990) state that the turnover of managers possessing only general human capital should not affect firm value. This can be also connected to the fact stated by Audas et al. (1999) that the managerial function is easily transferable between clubs because the latter are homogeneous.

Figure 1 Cumulative abnormal returns around the announcement of management change

The figure illustrates cumulative abnormal returns for the sample of 79 managerial changes. Daily average abnormal returns are cumulated over a period from 50 days prior announcement to 50 days after. Cumulative abnormal returns are calculated for each day in the event window.



7.5 Summary of the results

The results for the empirical analysis are presented in Table 25. The results are for the game-related analysis fairly consistent with earlier empirical findings by Brown and Hartzell (2001) and Dobson and Goddard (2001). Table 25 summarizes the hypotheses presented in the Chapter 4 and the results for these hypotheses.

Table 25 Hypotheses of the study and empirical findings

Hypothesis	Formulation	Empirical Findings
H_1	Revenue and performance are positively related.	Null hypothesis is supported by the findings: revenue and performance are positively related.
H_2	Profit and performance are positively related.	No support for null hypothesis.
H_3	Returns and trading activity (e.g., volume and volatility) in the shares of the football clubs are related to team performance (i.e., game results).	Null hypothesis is supported by the findings: trading activity is impacted by the games and returns are related to game results.
H_4	Investors (and therefore returns) respond symmetrically to positive and negative (unexpected) team performance.	Null hypothesis is rejected for the unadjusted game outcomes. Losses are penalized more than wins are rewarded. However, the evidence from the expectation-adjusted outcomes fails to reject null hypothesis.
H_5	The market reacts more strongly to the unexpected outcome than to expected outcome.	Mixed support for the null hypothesis. The market reacts to both expected and unexpected outcomes.
H_6	The European competitions, national cups and relegation/promotion games have a more significant impact on returns than regular season results.	Null hypothesis is supported for the part of European competitions, national cups and relegation games. The evidence is insignificant regarding promotions.
H_7	If there is a private component to game-related information, it will not affect prices until after the market has opened.	Null hypothesis is supported by the pooled data and the sample of English and Scottish clubs. The sample of clubs from other markets provides support for the public information hypothesis.
H_8	Managerial tenure and team performance (playing performance) are positively related.	Null hypothesis is supported by evidence from the regression analysis (not strong).
H_9	Managerial changes manifest as abnormal returns.	No support for null hypothesis.

7.6 Discussion of the results

This chapter briefly discusses the key findings and their implications. I will first discuss the findings from the game-related analysis, followed by the discussion on the findings from the timeliness of information analysis. This subchapter is concluded by findings related to the managerial changes

7.6.1 Discussion of the results: Game-related events

The results indicate that operating revenue is related to the playing performance while there is no such evidence for operating profit. It seems that the added impact on revenues due to a better performance on field during the previous and/or current season may be achieved by spending more on player transfers and player wages. Thus, better performance leads to higher operating revenue, but to achieve the better performance, clubs, on average, have to spend more. Whitney's (1993) findings suggest that in a pursue of a league championship, the market for star athletes in professional sports could cause increasing costs and lead to bankruptcy. Szymanski and Kyupers (1999) also study the relation between profit and team performance and find a significant relation between revenues and performance, but not between profits and performance. They state that there is no simple formula that relates financial success to success on the field of play (Szymanski and Kuypers, 1999, 29).

Brown and Hartzell (2001) find that for North American teams the relation between lagged winning percentage and franchise value is positive and statistically significant as well as lagged winning percentage and operating income. They also find that changes in net basketball revenue and net basketball revenue per share for Boston Celtics LP are related to the lagged number of wins. In other words, their results show that successful (in terms of wins) sports franchises are profitable. Furthermore, winning increases franchise value. The relation between teams' revenues and winning percentages is also confirmed by e.g. Scully (1974) and Medoff (1976).

The volume tests support the hypothesis that the games matter to the investors, and there is an order to sizes. The smallest volume occurs on off-season days, followed by on-season days that do not follow a game, with the highest volume occurring during the season on days following the games, which is similar to the findings of Brown and Hartzell (2001). For volatility, there is not such clear ordering to support the hypothesis. The lowest volatility occurs on on-season trading days not following the game, followed by off-season volatility, with the highest volatility occurring during the season on days following the games. Off-season volatility is higher than on-season, which is contrary to what Brown and Hartzell (2001) show. However, in general, the empirical results provide support to the hypothesis that trading activity and games are related. An explanation for higher volatility during off-season could be player transfers, but that would need to be further examined.

Evidence in this thesis shows that returns are related to the team performance. Investors respond differently to wins, draws, and losses, both the expected and unexpected ones. This is inconsistent with the study of Pearce and Roley (1983) who find that stock prices respond only to the unanticipated change in the money supply as predicted by the efficient market hypothesis. Furthermore, for unadjusted outcome the responses, i.e., mean returns, are asymmetric. Losses are penalized more than wins are rewarded, which leads to the rejection of the fourth hypothesis that investor respond symmetrically to wins and losses. This is consistent with Brown, Harlow, and Tinic (1988), who find evidence to the uncertain information hypothesis that following news of a dramatic financial event, both the risk and expected return of the affected companies increase systematically, and that prices react more strongly to bad news than good. Also Camerer (1989) finds that in assessing a team's outlook, bettors place different weights on winning and losing streaks and thus, losing streaks are more likely to continue than winning streaks. Moreover, for the expectation-adjusted outcomes, the market responses are different, meaning that there is an ordering in the returns according to the unexpectedness, wins produce positive, losses negative returns and draws both positive and negative, depending on the unexpectedness, which would support the fifth hypothesis, that investors react more strongly to unexpected than expected outcomes. The symmetry hypothesis cannot be rejected for the expectation-adjusted outcomes, which would support the fourth hypothesis. These findings are to a great extent similar to those of Brown and Hartzell (2001), who find that games contain value-relevant information that is used by investors and get mixed support for the symmetry hypothesis. However, in their study, there is no obvious change in estimated relation when point spreads are used to capture market expectations.

The findings offer support for the hypothesis that the stock market's expectations reflect the betting market expectations. Brown and Hartzell (2001) find only moderate support for the integration of betting market and stock market. If both markets have the same expectations, the unexpected win (loss) should show a greater (more negative) return than the expected win (loss). This is reflected in the returns for the realized events of draws and losses. For the expectation-adjusted outcomes, the support is not as strong for the realized outcome of wins. However, if the win data were split into two expected point groups instead of four, this would also support the assumption of unexpected result yielding a higher return than the expected.

Regression analysis confirms that unexpected outcome is significant, which is consistent with e.g. Datta and Dhillon (1993) and Joy et al. (1977) who find that investors respond to the unexpected element of announcements. Also, the importance of cup games is investigated, and empirical support to their relative importance to investors compared to regular league games is found, which can be seen as similar due to the knock-out nature of the cup to the results of Brown and Hartzell (2001), who find that the playoff effect is significant above and beyond the regular-season games. Also, Dobson and Goddard (2001) find the unexpected outcome coefficient more significant than the unadjusted coefficient.

The major game related events, such as eliminations from domestic cups and European competitions and promotion and relegation related events are studied in the similar manner as Dobson and Goddard (2001), but for a larger sample and for a longer time period. All, except promotion related events, are found significant, at least for the first post-event trading day, while Dobson and Goddard find significant stock market reaction to all the events. In general, the results of this study show that investors rational in the sense that they react most to the information that has direct, observable impact to the cash flows. However, the results of this study for the domestic cup variable could be more significant, if only the major cup per country, such as the FA Cup, were taken into account and the league cups, which do not have the same prestige, were not included. The same applies to European competitions, that is, not to include anything else except Champions' League games and UEFA cup games. Furthermore, missing odds can cause an underestimation of reaction to cup games in the regression. Another problematic issue is distinguishing afterward the exact timing of certainty relegation or avoiding relegation, promotion or failing to gain promotion.

7.6.2 Discussion of the results: Timeliness of information

The findings show that private component of game-related information affects prices after the market has opened. For the full sample, as the open-market volatility is higher for trading periods directly following games, which suggests that games cause investors to revise their private beliefs about the firm and incorporate this in the prices the next day. Median closed-market volatility for periods that include games is significantly higher than closed-market volatility of no-game periods, which offers support for the hypothesis that the timing of public information leads to the difference between open- and closed-market volatility. Comparing the groups by actual and expected outcome, for significant results, both closed-market volatility and open-market volatility are always higher when games are played than when games are not played. However, unexpected losses do not result in significantly higher volatility on trading days following these outcomes, and for unexpected wins, only closed-market volatility is significantly higher than when no game is played. The conclusions are to an extent consistent with Brown and Hartzell (2001), Chang, Jain and Locke (1995), and French and Roll (1986) that high trading-time volatility is caused by private information that can only be acted upon when markets are open.

Differences for markets are clear. For other markets the closed-market volatility is higher than open-market volatility when games are played, while for the European and Scottish clubs the opposite is true. This means that for other markets the investors are trading on the public information. The conclusions for the other European clubs are consistent with Ederington and Lee (1993), Stoll and Whaley (1990), and Harvey and Huang (1991) that public information released when the market is open is primarily responsible for higher open-market volatility. Also these findings are similar to Jones, Kaul, and Lipson's (1994), who provide evidence that public information is the major source of short-term return volatility.

7.6.3 Discussion of the results: Managerial changes

The relation between managerial tenure and team performance is found to be positive and significant, which is consistent with the findings of Scully (1995) and Audas et al. (1997), and the findings of e.g. Warner et al. (1988) and Kang and Shivdasani (1995) from other businesses, that poor performance and managerial turnover are related. However, unlike for Audas et al. (1999), the results do not show that short-term fluctuations in team performance would have a significant impact on the managerial terminations.

The results from the event study of managerial changes and share price reactions around the announcement date are not statistically significant. One potential reason for the failure of finding a significant reaction is, as in the studies of Warner et al. (1988) and Mahajan and Lummer (1993) for the pooled sample that the sample does not separate between different forms of turnovers, e.g. end of contract, voluntary or involuntary termination, as the sample size is fairly small. The data collection and the separation of cases will require further input. Another possible reason for no market response to change is related to the human capital of football managers. Becker (1964) suggests that the managerial human capital can be seen as general or firm-specific. General human capital, which is easily and costlessly replaceable, should not affect firm value. Audas et al. (1999) state that the managerial function is easily transferable between clubs because the latter are homogeneous. They also find that managerial human capital is only significant in the case of a voluntary termination.

8 CONCLUSIONS

8.1 Summary of the findings

The objective of the study is to gather further evidence on information effects on equity prices by studying the market reaction on the game and non-game events of listed football clubs. As a topic studying the information effects on security prices by using football games as a proxy for public information is interesting because the signals are frequent, easy to quantify, occur when the market is closed, and there are observable ex ante expectations. The expected value of the signal is controlled by using betting market fixed odds.

In this thesis, nine hypotheses related to game and non-game events are tested. First, the effect of team performance on operating revenue and operating profit is investigated. Team performance is found to have an impact on operating revenue, but not on the operating profit. However, no relation between team performance and operating revenue is found in the sample for clubs from countries other than England and Scotland.

Also, the impact of sample football clubs' games on their respective shares is analyzed. This analysis shows that investors are trading on the basis of game results. Volume is higher during the football season, although volatility is higher during the off-season. Moreover, both volume and volatility are higher on post-game trading days than trading days that do not follow games. Returns also reflect game results. However, this reflection is asymmetric. Losses are penalized more than wins are rewarded. European competitions, domestic cup games and relegation games have an even greater impact, but promotion games fail to show the hypothesized positive effect.

A more interesting feature of the stock market's reaction is its potential incorporation of the expected game results. If the betting market and stock market are integrated (i.e., participants in these markets have the same expectations), then controlling for the betting market fixed odds should isolate the unexpected component of the game results. The evidence is mixed with respect to this hypothesis. The market reacts to both expected and unexpected outcome. For example, unexpected wins are not found significant, but fairly expected draws and losses are significant and have a negative impact. However, comparing unexpected and expected wins, and unexpected and expected losses, the unexpected wins and losses are greater than their expected counterparts, and the losses even significantly so. In the regressions, the unexpected outcome has a significant, but quite small, effect. The unexpected cup outcomes have a bit greater impact on the abnormal returns. All in all, this evidence is interpreted to give at least moderate support to the betting and stock market integration hypothesis.

Also, the impact of information on volatility is examined. Previous research has documented that volatility is higher when the stock market is open. This research seeks to attribute such a finding to the timing of public information releases, private information and/or noisy trading. Football matches are played when the market is closed but their effect on volatility is not observed until the next time the market is open. The findings are consistent with the private information hypothesis for the pooled sample, and especially for the subsample of English and Scottish clubs. However, the subsample of clubs from other markets shows evidence that investors seem to be trading more on public information since the closed-market volatility is higher than open-market volatility for all significant results, except for an expected win. The support for betting market and stock market integration from investigating volatilities is mixed. In the pooled sample, for wins, the effect is strongest for unexpected outcomes, but for losses, the effect is strongest for expected outcomes.

The final part analyzes managerial changes. First, the relation between managerial changes and team performance is investigated and a significant positive relation is found between managerial tenure and playing performance for the whole managerial spell. Second, the impact of managerial changes to the football clubs' share prices is examined. However, no significant reaction around the announcement date is not found, which can be due to not partitioning the sample by termination reasons. It could also imply that the stock market considers the football managers possessing general human capital and being easily replaceable with managers with similar skills.

8.2 Suggestions for further research

Further analysis could shed some light to the question whether listed football clubs are profit maximizers, as assumed of North American professional sports teams by Rottenberg (1956) and Neale (1964), or utility maximizers, whose main objective is to maximize team success subject to a financial solvency constraint, as proposed for football clubs in general by Sloane (1971). In other words, does the fact that clubs have listed to the stock market change the main objectives to making profit?

A motivating topic to study would be to investigate whether the stock market reacts more strongly to football clubs' winning and losing streaks than to separate game results, to examine, whether the 'hot hand' phenomenon takes place. Also, an event study approach using the date when a relegation or a promotion is certain as the event day could bring more evidence on the effects of relegation and promotion to stock prices.

Player transfers are another challenging topic for further study. It would be interesting to see the impact of different types of transfers, such as free agents, juniors, and players with contracts not expired, on stock prices. The problems for an event study of this type are, however, the wild speculations taking place well before the event and for a pooled sample, proxying for the free agents.

Managerial changes could be studied further by looking at the impact of the events on the trading volume, as the stocks of football clubs are generally fairly illiquid. Also, more understanding of the topic could be gained through studying whether there is significance in the return in the origin of the follower or size of the company. Furthermore, investigating the reasons behind the terminations and partitioning the sample into e.g. voluntary termination, involuntary termination, and contract ending, would likely improve the size and the statistical significance of the abnormal returns. To study the relation between managerial changes and playing performance league position in the beginning and in the end could be used as an independent variable, although doing this for a large sample will be quite work-intensive.

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APPENDICES

Appendix 1 Sample clubs

This table details the sample clubs, their country, stock exchange listing date, sample time period, and their division level for each season.

				Division							
Company	Country	Listing date	Sample period	1997/98	1998/99	1999/2000	2000/01	2001/02	2002/03	2003/04	2004/05
Arsenal Holdings	England	09/05/2002	Sept. 9, 2002 – Apr. 12, 2004	E0	E0	E0	E0	E0	E0	E0	E0
Aston Villa	England	06/05/1997	Aug. 1, 1998 – Apr. 12, 2004	E0	E0	E0	E0	E0	E0	E0	E0
Birmingham City	England	06/03/1997	Aug. 1, 1998 – Apr. 12, 2004	E1	E1	E1	E1	E1	E0	E0	E0
Burnden Leisure (Bolton Wanderers)	England	28//04/1997	Aug. 1, 1998 - May 1, 2003	E0	E1	E1	E1	E0	E0	E0	E0
Charlton Athletic	England	20/03/1997	Aug. 1, 1998 – Apr. 12, 2004	E1	E0	E1	E0	E0	E0	E0	E0
Chelsea Village	England	29/03/1996	Aug. 1, 1998 – Aug. 22, 2003	E0	E0	E0	E0	E0	E0	E0	E0
Leeds United	England	02/08/1996	Aug. 1, 1998 – Feb. 27, 2004	E0	E0	E0	E0	E0	E0	E0	E1
Leicester City	England	22/04/1997	Aug. 1, 1998 – Oct. 10, 2002	E0	E0	E0	E0	E0	E1	E0	E1
Manchester United	England	07/06/1991	Aug. 1, 1998 – Apr. 12, 2004	E0	E0	E0	E0	E0	E0	E0	E0
Millwall Holdings	England	13/10/1989	Aug. 1, 1998 – Apr. 12, 2004	E2	E2	E2	E2	E1	E1	E1	E1
Newcastle United	England	01/04/1997	Aug. 1, 1998 – Apr. 12, 2004	E0	E0	E0	E0	E0	E0	E0	E0
Preston North End	England	13/09/1995	Aug. 1, 1998 – Apr. 12, 2004	E2	E2	E2	E1	E1	E1	E1	E1
Sheffield United	England	16/01/1997	Aug. 1, 1998 – Apr. 12, 2004	E1	E1	E1	E1	E1	E1	E1	E1
Southampton Leisure Holdings	England	14/01/1997	Aug. 1, 1998 – Apr. 12, 2004	E0	E0	E0	E0	E0	E0	E0	E0
Sunderland	England	23/12/1996	Aug. 1, 1998 – Apr. 12, 2004	E1	E1	E0	E0	E0	E0	E1	E1
Tottenham Hotspurs	England	12/10/1983	Aug. 1, 1998 – Apr. 12, 2004	E0	E0	E0	E0	E0	E0	E0	E0
Watford Leisure	England	01/08/2001	Aug. 29, 2001 – Apr. 12, 2004	E2	E1	E0	E1	E1	E1	E1	E1
West Bromwich Albion	England	02/01/1997	Aug. 1, 1998 – Apr. 12, 2004	E1	E1	E1	E1	E1	E0	E1	E0
Glasgow Celtic	Scotland	28/09/1995	Aug. 1, 1998 – Apr. 12, 2004	SC0	SC0	SC0	SC0	SC0	SC0	SC0	SC0
Heart of Midlothian	Scotland	16/05/1997	Aug. 1, 1998 – Apr. 12, 2004	SC0	SC0	SC0	SC0	SC0	SC0	SC0	SC0
AS Roma	Italy	22/05/2000	Jun. 20, 2000 – Apr. 12, 2004	I0	I0	I0	I0	I0	I0	I0	I0
Juventus	Italy	19/12/2001	Jan. 16, 2002 – Apr. 12, 2004	I0	I0	I0	I0	I0	I0	I0	I0
SS Lazio	Italy	06/05/1998	Aug. 1, 1998 – Apr. 12, 2004	I0	I0	I0	I0	I0	I0	I0	I0
Borussia Dortmund	Germany	30/10/2000	Nov. 27, 2000 – Apr.12, 2004	G0	G0	G0	G0	G0	G0	G0	G0
AFC Ajax	Netherlands	11/05/1998	Aug. 1, 1998 – Apr. 12, 2004	N0	N0	N0	N0	N0	N0	N0	N0
AAB Aalborg	Denmark	14/09/1998	Oct. 10, 1998 – Apr. 12, 2004	D0	D0	D0	D0	D0	D0	D0	D0
AGF Kontraktfodbold	Denmark	20/05/1988	Aug. 1, 1998 – Apr. 12, 2004	D0	D0	D0	D0	D0	D0	D0	D0

(Continued)

Appendix 1 continued

Company	Country	Listing date	Sample period	Division							
				1997/98	1998/99	1999/2000	2000/01	2001/02	2002/03	2003/04	2004/05
Akademisk Boldklub	Denmark	03/12/1998	Dec. 31, 1998 – Apr. 12, 2004	D0	D0	D0	D0	D0	D0	D0	D1
Brondby IF	Denmark	05/04/1988	Aug. 1, 1998 – Apr. 12, 2004	D0	D0	D0	D0	D0	D0	D0	D0
Parken Sport & Ent. (FCK)	Denmark	13/11/1997	Aug. 1, 1998 – Apr. 12, 2004	D0	D0	D0	D0	D0	D0	D0	D0
SIF Fodbold	Denmark	07/10/1991	Aug. 1, 1998 – Apr. 12, 2004	D0	D0	D0	D0	D0	D0	D1	D0
Sporting Lisbon	Portugal	02/06/1998	Aug. 1, 1998 – Apr. 12, 2004	P0	P0	P0	P0	P0	P0	P0	P0

Legend for division levels
E0 = English Premier League
E1 = Football League Championship (English First Division)
E2 = Football League One (English Second Division)
SC0 = Scottish Premier League
I0 = Serie A (Italian Premier League)
G0 = Bundesliga 1 (German Premier League)
N0 = KPN Eredivisie (Dutch Premier League)
D0 = SAS Ligaen (Danish Premier League)
D1 = Danish First Division
P0 = Superliga (Portuguese Premier League)

Appendix 2 Revenue, profit, and team performance – England and Scotland

This table presents results of regressions of operating revenue and operating profit on team performance for the 1999-2004 period for English and Scottish teams. Team performance is measured as a league position and percentage of points gained in both all and only league games during one season. Dummy variables for each sport-year are included in the regressions. *Operating revenue* and *Operating profit* are in British pounds and are from the Amadeus company database. *p*-values are presented in parentheses. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

	Operating revenue$_{i,t}$	*Operating profit$_{i,t}$*	*Operating revenue$_{i,t}$*	*Operating profit$_{i,t}$*	*Operating revenue$_{i,t}$*	*Operating profit$_{i,t}$*
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	80,907,462	4,370,027	-71,144,706	-10,667,386	-53,729,740	-10,554,213
	(0.000)***	(0.327)	(0.001)***	(0.212)	(0.005)***	(0.163)
League position$_{i,t}$	-1,758,175	-482,952				
	(0.003)***	(0.107)				
League position $_{i,t-1}$	-1,382,692	323,434				
	(0.011)**	(0.248)				
% of max. points, all games$_{i,t}$			100,047,291	3,096,569		
			(0.004)***	(0.818)		
% of max. points, all games$_{i,t-1}$			97,608,759	20,014,460		
			(0.006)***	(0.148)		
% of max. points, league games$_{i,t}$					86,281,425	2,247,539
					(0.008)***	(0.857)
% of max. points, league games$_{i,t-1}$					82,257,090	21,135,598
					(0.014)**	(0.104)
Sport-year 2000 dummy	5,121,925	-5,641,905	6,602,329	-5,370,272	6,772,207	-5,556,303
	(0.617)	(0.307)	(0.625)	(0.330)	(0.617)	(0.310)
Sport-year 2001 dummy	7,573,366	-5,751,647	8,000,376	-4,502,005	6,995,620	-4,468,748
	(0.465)	(0.295)	(0.554)	(0.404)	(0.606)	(0.404)
Sport-year 2002 dummy	12,348,940	-8,955,986	17,916,975	-7,758,641	15,836,171	-8,263,207
	(0.212)	(0.093)*	(0.165)	(0.139)	(0.222)	(0.114)
Sport-year 2003 dummy	17,207,019	-5,491,932	30,561,281	-5,036,471	28,499,203	-5,443,591
	(0.081)*	(0.296)	(0.020)**	(0.336)	(0.030)**	(0.297)
Sport-year 2004 dummy	22,341,549	-4,467,272	28,714,406	-3,215,989	27,094,346	-3,416,117
	(0.022)**	(0.387)	(0.026)**	(0.533)	(0.036)**	(0.504)
F	18.250	0.738	5.565	0.784	5.448	0.949
Significance F	(0.000)***	(0.641)	(0.000)***	(0.603)	(0.000)***	(0.474)
Number of teams	17	17	17	17	17	17
Observations	89	84	89	84	89	84
R^2	0.612	0.064	0.325	0.067	0.320	0.080

Appendix 3 Revenue, profit, and team performance – Denmark, Germany, Holland, Italy, and Portugal

This table presents results of regressions of operating revenue and operating profit on team performance for the 1999-2004 period for Danish, German, Italian, Dutch and Portuguese teams. Team performance is measured as a league position and percentage of points gained in both all and only league games during one season. Dummy variables for each sport-year are included in the regressions. *Operating revenue* and *Operating profit* are in British pounds and are from the Amadeus company database. *p*-values are presented in parentheses. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

	Operating revenue$_{i,t}$	*Operating profit$_{i,t}$*	*Operating revenue$_{i,t}$*	*Operating profit$_{i,t}$*	*Operating revenue$_{i,t}$*	*Operating profit$_{i,t}$*
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	64,402,363	7,763,898	-96,774,090	-6,793,734	-97,738,797	-7,087,508
	(0.038)**	(0.690)	(0.172)	(0.892)	(0.091)*	(0.866)
League position$_{i,t}$	-1,366,710	-2,647,607				
	(0.666)	(0.196)				
League position $_{i,t-1}$	-2,145,660	-1,619,287				
	(0.486)	(0.425)				
% of max. points, all games$_{i,t}$			90,726,011	17,082,665		
			(0.269)	(0.768)		
% of max. points, all games$_{i,t-1}$			136,536,821	-18,456,494		
			(0.093)*	(0.745)		
% of max. points, league games$_{i,t}$					96,365,249	19,991,648
					(0.161)	(0.691)
% of max. points, league games$_{i,t-1}$					129,443,252	-19,731,756
					(0.057)*	(0.688)
Sport-year 2000 dummy	-1,694,697	4,752,921	17,497,634	418,698	18,368,471	-148,579
	(0.957)	(0.815)	(0.573)	(0.985)	(0.535)	(0.995)
Sport-year 2001 dummy	-2,085,536	-8,000,180	18,662,645	-8,629,623	16,209,920	-9,817,891
	(0.947)	(0.693)	(0.547)	(0.696)	(0.587)	(0.658)
Sport-year 2002 dummy	-5,397,733	-23,908,583	8,826,130	-18,968,543	3,542,687	-19,745,516
	(0.859)	(0.228)	(0.761)	(0.363)	(0.899)	(0.344)
Sport-year 2003 dummy	10,734,475	-17,584,227	24,829,143	-13,304,785	21,227,997	-13,688,911
	(0.720)	(0.362)	(0.384)	(0.506)	(0.435)	(0.491)
Sport-year 2004 dummy	2,616,707	-14,931,556	18,069,360	-14,457,386	13,884,689	-15,408,006
	(0.931)	(0.446)	(0.545)	(0.500)	(0.629)	(0.471)
F	0.250	0.707	0.900	0.311	1.375	0.324
Significance F	(0.969)	(0.666)	(0.518)	(0.944)	(0.247)	(0.938)
Number of teams	9	9	9	9	9	9
Observations	42	43	42	43	42	43
R^2	0.049	0.124	0.156	0.059	0.221	0.061

Appendix 4 Robustness of the results - Analysis on revenue and performance

To test the robustness of the results from regressions of operating revenue on team performance, operating revenue is transformed into natural logarithm. Table A4a reports the results. For the pooled sample, the results from the regressions remain significant, except for the current percentage of points gained in league games. League position variables are slightly more statistically significant, while the point percentages are slightly less significant. The England and Scotland sample shows results of slightly lesser significance, whereas the sample from other markets has a better model fit for the regressions with percentages of points gained in all and league games and more significance for these variables. All in all, the results from the regressions with the natural logarithm of operating revenue as the dependent variable confirm the finding presented earlier in this study: operating revenue and team performance are positively related - the better the performance, the higher the operating revenue.

To test the robustness of the league position variable, the log transformation used by Szymanski and Kuypers (1999) is applied. The variable is formed as follows:

$$League\ position_{i,t} = -ln[League\ ranking_{i,t} / (93 - League\ ranking_{i,t})]$$

It is questionable whether this transformation can be used for teams from other leagues than the English league, as the number of teams in the league and the division differs between countries. However, in the pooled model, the teams need to be measured with the same scale, and thus, the assumption of 92 league teams is applied to all. Table A4b reports the results of the analysis.

For the pooled sample, [regressions (1) and (2)], the results are much similar to the ones reported in Table 12, except the log transformation results in a statistically significant lagged league position, and both league position variables are significant at the 0.05 level. Also, for operating profit regression, the dummy variable for the sport-year 2002 is significant at the 0.1 level. Also, for the England and Scotland sample [regressions (3) and (4)], the results are similar to those reported in Appendix 2 and also the sport-year 2003 and 2004 dummy variables for the operating revenue regression are significant, but the sport-year 2002 dummy variable is not significant for operating profit regression. For other markets [regressions (5) and (6)], the results are much the same as those reported in Appendix 3.

Table A4a Operating revenue and team performance

This table presents results of regressions of natural logarithm of operating revenue on team performance for the 1999-2004 period. Team performance is measured as league position and percentage of points gained in both all and only league games during one season. Dummy variables for each sport-year are included in the regressions with 1999 as the base year. *Operating revenue* is in British pounds and from the Amadeus company database. *p*-values are presented in parentheses. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

	All clubs			England and Scotland			Denmark, Germany, Holland, Italy, Portugal		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	17.903	15.104	15.487	18.210	15.120	15.482	17.970	12.957	13.404
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
League position$_{i,t}$	-0.042			-0.053			-0.030		
	(0.009)***			(0.000)***			(0.728)		
League position $_{i,t-1}$	-0.018			-0.029			-0.025		
	(0.241)			(0.000)***			(0.768)		
% of max. points, all games$_{i,t}$		1.358			1.527			3.327	
		(0.075)*			(0.056)*			(0.130)	
% of max. points, all games$_{i,t-1}$		2.292			1.991			4.077	
		(0.003)***			(0.015)**			(0.060)*	
% of max. points, league games$_{i,t}$			1.137			1.313			3.251
			(0.104)			(0.081)*			(0.081)*
% of max. points, league games$_{i,t-1}$			1.864			1.589			3.405
			(0.009)***			(0.041)**			(0.062)*
Sport-year 2000 dummy	-0.057	0.050	0.038	0.128	0.173	0.174	-0.482	0.185	0.126
	(0.828)	(0.865)	(0.898)	(0.368)	(0.581)	(0.583)	(0.578)	(0.822)	(0.874)
Sport-year 2001 dummy	-0.102	0.120	0.087	0.174	0.229	0.217	-0.606	0.066	-0.101
	(0.701)	(0.684)	(0.771)	(0.228)	(0.466)	(0.493)	(0.484)	(0.936)	(0.899)
Sport-year 2002 dummy	0.008	0.223	0.168	0.313	0.490	0.454	-0.659	-0.304	-0.507
	(0.976)	(0.431)	(0.555)	(0.024)**	(0.103)	(0.134)	(0.432)	(0.693)	(0.502)
Sport-year 2003 dummy	0.263	0.520	0.471	0.427	0.725	0.689	-0.252	0.140	-0.009
	(0.302)	(0.071)*	(0.103)	(0.002)***	(0.017)**	(0.025)**	(0.761)	(0.852)	(0.990)
Sport-year 2004 dummy	0.253	0.517	0.464	0.460	0.635	0.602	-0.384	0.061	-0.127
	(0.322)	(0.074)*	(0.110)	(0.001)***	(0.033)**	(0.045)**	(0.644)	(0.938)	(0.869)
F	9.806	3.995	3.811	62.742	3.774	3.481	0.180	1.269	1.614
Significance F	(0.000)***	(0.001)***	(0.001)***	(0.000)***	(0.001)***	(0.003)***	(0.988)	(0.294)	(0.165)
Number of teams	26	26	26	17	17	17	9	9	9
Observations	131	131	131	89	89	89	42	42	42
R^2	0.358	0.185	0.178	0.844	0.246	0.231	0.036	0.207	0.249

Table A4b Operating revenue, operating profit, and league position

This table presents results of regressions of operating revenue and operating profit on league position for the 1999-2004 period. League position is measured as the logarithmic transformation: *-ln[League ranking*$_{i,t}$ */ (93 – League ranking*$_{i,t}$*)]*. Dummy variables for each sport-year are included in the regressions with 1999 as the base year. *Operating revenue* and *Operating profit* are in British pounds and are from the Amadeus company database. *p*-values are presented in parentheses. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively.

	All clubs		England and Scotland		Denmark, Germany, Holland, Italy, Portugal	
	Operating revenue$_{i,t}$	*Operating profit*$_{i,t}$	*Operating revenue*$_{i,t}$	*Operating profit*$_{i,t}$	*Operating revenue*$_{i,t}$	*Operating profit*$_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-6,169,470	1,900,852	-22,504,791	-2,824,285	2,751,686	-58,559,860
	(0.538)	(0.766)	(0.006)***	(0.542)	(0.956)	(0.078)*
League position$_{i,t}$	9,394,766	1,425,820	15,329,030	2,919,647	5,363,613	8,681,062
	(0.042)**	(0.615)	(0.003)***	(0.312)	(0.598)	(0.179)
League position$_{i,t-1}$	9,670,214	-2,235,570	12,524,446	-648,322	8,426,602	5,865,687
	(0.032)**	(0.421)	(0.014)**	(0.819)	(0.396)	(0.361)
Sport-year 2000	1,786,080	-4,951,321	3,843,401	-5,845,700	240,205	4,750,230
	(0.872)	(0.488)	(0.683)	(0.288)	(0.994)	(0.818)
Sport-year 2001	1,980,806	-7,572,724	6,519,008	-4,929,280	-795,282	-6,960,795
	(0.859)	(0.287)	(0.490)	(0.362)	(0.980)	(0.732)
Sport-year 2002	5,072,189	-13,094,051	13,212,917	-8,164,129	-4,622,133	-23,663,144
	(0.637)	(0.059)*	(0.143)	(0.120)	(0.880)	(0.238)
Sport-year 2003	16,071,763	-9,543,866	19,820,108	-5,653,388	10,782,140	-17,481,184
	(0.136)	(0.163)	(0.029)**	(0.279)	(0.716)	(0.361)
Sport-year 2004	17,057,946	-8,367,511	23,241,180	-4,343,071	3,887,878	-14,074,095
	(0.114)	(0.226)	(0.010)***	(0.398)	(0.897)	(0.472)
F	9.639	0.746	23.766	0.831	0.322	0.798
Significance F	(0.000)***	(0.634)	(0.000)***	(0.565)	(0.939)	(0.594)
Number of teams	26	25	17	17	9	9
Observations	131	127	89	84	42	43
R^2	0.354	0.042	0.673	0.071	0.062	0.138

Appendix 5 League winners

Country	Cup	Season 1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
England	English Premier League	Manchester United	Manchester United	Manchester United	Arsenal	Manchester United	Arsenal
	Football League Championship	Sunderland	Charlton Athletic	Fulham	Manchester City	Portsmouth	Norwich
	Football League One	Fulham	Preston North End	Millwall	Brighton	Wigan	Plymouth
Scotland	Premier League		Glasgow Rangers	Celtic	Celtic	Glasgow Rangers	Celtic
Denmark	SAS Ligaen	Aalborg	Herfolge BK	FC København	Brondby IF	FC København	FC København
Germany	Bundesliga 1	FC Bayern Munchen	FC Bayern Munchen	FC Bayern Munchen	Borussia Dortmund	FC Bayern Munchen	SV Werder Bremen
Italy	Serie A	AC Milan	SS Lazio	AS Roma	Juventus	Juventus	AC Milan
Netherlands	KPN Eredivisie	Feyenoord	P.S.V. Eindhoven	P.S.V. Eindhoven	AFC Ajax	P.S.V. Eindhoven	AFC Ajax
Portugal	Superliga	FC Porto	Sporting Lisbon	Boavista FC	Sporting Lisbon	FC Porto	FC Porto

Appendix 6 Domestic cup winners

LDV Vans Trophy is a cup for lower divisions, and was participated in by Millwall and Preston in the sample.

Country	Cup	Season					
		1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
England	FA Cup	Manchester United	Chelsea	FC Liverpool	Arsenal	Arsenal	Manchester United
	League Cup	Tottenham Hotspur	Leicester City	FC Liverpool	Blackburn	Liverpool	Middlesbrough
	LDV Vans Trophy	Wigan	Stoke	Port Vale	Blackpool	Bristol City	Blackpool
Scotland	Scottish FA Cup	Glasgow Rangers	Glasgow Rangers	Celtic	Glasgow Rangers	Glasgow Rangers	Celtic
	Scottish League Cup	Glasgow Rangers	Celtic	Celtic	Glasgow Rangers	Glasgow Rangers	Livingston
Denmark	Danish Cup	AB Copenhagen	Viborg FF	Silkeborg IF	OB	Brondby IF	FC Copenhagen
Germany	German Cup	SV Werder Bremen	FC Bayern Munchen	FC Schalke 04	FC Schalke 04	FC Bayern Munchen	SV Werder Bremen
	German League Cup	FC Bayern Munchen	FC Bayern Munchen	Hertha BSC	Hertha BSC	Hamburger SV	FC Bayern Munchen
Italy	Coppa Italia	Parma	SS Lazio	Fiorentina	Parma	AC Milan	SS Lazio
Portugal	Portuguese Cup	SC Beira-Mar	FC Porto	FC Porto	Sporting Lisbon	FC Porto	SL Benfica
Netherlands	Netherlands Cup	AFC Ajax	Roda J.C.	F.C. Twente	AFC Ajax	F.C. Utrecht	F.C. Utrecht

Appendix 7 International cup winners

In Intertoto cup there can be up to three winners in the same competition during the same season.

Cup	Season					
	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
European Cup (Champions' League)	Manchester United	Real Madrid	FC Bayern Munchen	Real Madrid	AC Milan	FC Porto
UEFA Cup	Parma	Galatasaray	FC Liverpool	Feyenoord	FC Porto	Valencia
Cup Winners' Cup	SS Lazio	N/A	N/A	N/A	N/A	N/A
Intertoto Cup	Valencia	Juventus	Celta Vigo	Aston Villa	VfB Stuttgart	Schalke
	Werder Bremen	West Ham	Udinese		Fulham	Perugia
	Bologna		VfB Stuttgart			Villarreal

Appendix 8 Regression results of market-adjusted returns on game result variables by actual and expected outcome [dependent variable: Abnormal Return (in basis points)]

This table presents the results of OLS regressions on unexpected game outcome and cup games for the sample clubs for the sample period from August 1, 1998 to .April 12, 2004. *p*-values are shown below coefficients. *Unexpected Outcome* derived by subtracting the expected outcome from the realized point result. Expected outcome is calculated by using betting market probabilities for potential game outcomes and multiplying each probability by the point payout. *Abnormal Return* is defined as the residual (in basis points) from a market-model regression of the daily club's return on the local market index return. The *Cup Game* dummy variable is equal to one when a cup game took place after the previous trading day and zero otherwise. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively

	E(points) 0 - 0.75		E(points) 0.75 - 1.5		E(points) 1.5 - 2.25		E(points) 2.25 - 3	
Win	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.595	0.585	-1.392	-1.446	-0.362	-0.329	0.754	0.815
	-0.963	-0.964	-0.205	-0.188	-0.38	-0.425	-0.433	-0.398
Unexpected Outcome $Y_{i,t}$	-0.068	-0.121	1.201	1.203	0.977	0.986	-1.112	-1.032
	-0.99	-0.982	(0.054)*	(0.054)*	(0.006)***	(0.006)***	-0.468	-0.5
Unexpected Outcome$_{it}$ * *Cup Game*$_{it}$		0.263		0.278		-0.326		-0.744
		-0.61		-0.2		-0.112		-0.191
Observations	64	64	990	990	1758	1758	461	461
Adj. R^2	-0.016	-0.028	0.003	0.003	0.004	0.005	-0.001	0.001
Draw	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Constant	1.668	1.643	0.464	0.463	0.33	0.322	1.445	1.227
	-0.114	-0.124	(0.012)**	(0.012)**	-0.421	-0.435	-0.7	-0.744
Unexpected Outcome $Y_{i,t}$	-3.677	-3.554	1.512	1.452	1.054	1.035	2.079	1.767
	-0.179	-0.207	(0.017)**	(0.025)**	(0.033)**	(0.039)**	-0.458	-0.53
Unexpected Outcome$_{it}$ * *Cup Game*$_{it}$		-0.417		0.758		0.077		0.745
		-0.834		-0.628		-0.831		-0.307
Observations	77	77	896	896	760	760	51	51
Adj. R^2	0.011	-0.002	0.005	0.004	0.005	0.003	-0.009	-0.008
Loss	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Constant	27.84	28.767	-2.643	-3.005	0.302	0.202	-0.894	-0.855
	-0.281	-0.271	(0.071)*	(0.039)**	-0.616	-0.737	-0.536	-0.553
Unexpected Outcome $Y_{i,t}$	12.488	12.772	-0.801	-1.127	1.001	0.798	-1.84	-2.031
	-0.261	-0.255	-0.325	-0.165	(0.051)*	-0.12	-0.436	-0.39
Unexpected Outcome$_{it}$ * *Cup Game*$_{it}$		0.387		0.849		0.886		1.685
		-0.528		(0.001)***		(0.001)***		-0.136
Observations	37	37	584	584	1272	1272	241	241
Adj. R^2	0.008	-0.009	0	0.018	0.002	0.01	-0.002	0.004

Appendix 9 Closed- and open-market price volatility – England and Scotland

This table presents the median price volatility for the sample clubs for times when the market is closed and open. The sample is broken into two groups based on whether a game was played since the last trading day. Volatilities for closed- and open-market periods are calculated from closing and opening prices. *p*-values for Mann-Whitney (U) tests for the differences between closed-market and open-market volatility, and between volatility for the periods that follow games, and do not follow games are also presented. Panel A shows results for the sample period August 1, 1998 to April 14, 2004. Panel B compares volatilities based on game outcome for the sample period. In addition to presenting the median volatility, the volatility for each subgroup is compared to the volatility when the market was closed or open, and no game was played. The asterisks represent significance of tests of equal volatility over these periods compared to all periods when the market is closed and no games are played. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. These data are from Datastream database.

Panel A: Median price volatility, annualized

Median price volatility (annualized)	Number of observations	Closed-market	Open-market	*p*-value Open>Closed
All trading days	25828	27.88%	35.62%	0.000***
No game since last trading day	20894	28.23%	35.56%	0.000***
Game since last trading day	4934	25.52%	35.85%	0.000***
p-value : game > no game		0.046**	0.380	
		no game>game	game>no game	

Panel B: Median price volatility by game outcome, annualized

Median price volatility, annualized	Win	Draw	Loss	No game
Closed-market	25.01%	23.34%	28.95%	28.23%
Open-market	34.15%	31.26%	41.82%	35.56%
p-value : open > closed	0.000***	0.003***	0.000***	0.000***
Observations	2258	1166	1510	20894
p-values : equal volatility to no game period				
p-value: game > no game (closed-market):	0.050**	0.098*	0.995	
	no game>win	no game>draw		
p-value: game > no game (open-market):	0.855	0.303	0.018**	
		no game>draw		

Appendix 10 Closed- and open-market price volatility by expected and actual game outcome – England and Scotland

This table presents median volatilities based on expected and actual game outcomes for the sample period of August 1, 1998 to April 14, 2004. For example, the (upper-left) closed-market-win (0-0.75) cell presents median volatility for times when the market is closed and the club was mainly expected to lose but won. Volatilities for closed- and open-market periods are calculated from closing and opening prices. p-values for Mann-Whitney (U) tests for the differences between closed-market and open-market volatility, and between volatility for the periods that follow games, and do not follow games are also presented. The asterisks represent significance of tests of equal volatility over these periods compared to all periods when the market is closed and no games are played. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. These data are from Datastream database.

Median price volatility by expected and actual game outcome, annualized

Realised event	Expected result (points) 0 - 0.75	0.75 - 1.5	1.5 - 2.25	2.25 - 3	Grand Total all	No game N/A
Win						
Closed-market	56.46%	31.47%	24.64%	21.22%	26.96%	28.23%
Open-market	43.02%	43.02%	34.74%	25.66%	36.42%	35.56%
p-value : open > closed	0.627	0.005***	0.000***	0.153	0.000***	0.000***
p-value : game > no game (closed-market)	closed > open 0.056*	0.369	0.266	0.013**	0.481	
p-value : game > no game (open-market)	0.606	0.025**	no game > game 0.529	no game > game 0.010***	no game > game 0.118	
Observations	33	662	1087	no game > game 226	4462	20894
Draw						
Closed-market	24.79%	28.23%	19.47%	35.29%		
Open-market	60.27%	34.74%	28.23%	30.72%		
p-value : open > closed	0.125	0.139	0.031**	0.513		
p-value : game > no game (closed-market)	0.988	0.678	0.012**	closed > open 0.812		
p-value : game > no game (open-market)	no game > game 0.053*	1.000	no game > game 0.067*	0.221		
Observations	56	585	no game > game 413	no game > game 23		
Loss						
Closed-market	41.82%	30.76%	23.28%	21.28%		
Open-market	47.38%	43.43%	41.63%	18.07%		
p-value : open > closed	0.408	0.002***	0.003***	0.729		
p-value : game > no game (closed-market)	0.037**	0.282	0.122	0.605		
p-value : game > no game (open-market)	0.084*	0.019**	no game > game 0.574	no game > game 0.522		
Observations	176	842	339	no game > game 17		

Appendix 11 Closed- and open-market price volatility – Germany, Holland, Italy, and Portugal

This table presents the median price volatility for the sample clubs for times when the market is closed and open. The sample is broken into two groups based on whether a game was played since the last trading day. Volatilities for closed- and open-market periods are calculated from closing and opening prices. *p*-values for Mann-Whitney (U) tests for the differences between closed-market and open-market volatility, and between volatility for the periods that follow games, and do not follow games are also presented. Panel A shows results for the sample period August 1, 1998 to April 14, 2004. Panel B compares volatilities based on game outcome for the sample period. In addition to presenting the median volatility, the volatility for each subgroup is compared to the volatility when the market was closed or open, and no game was played. The asterisks represent significance of tests of equal volatility over these periods compared to all periods when the market is closed and no games are played. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. These data are from Datastream database.

Panel A: Median price volatility, annualized

Median price volatility (annualized)	Number of observations	Closed-market	Open-market	*p*-value Open > Closed	
All trading days	6637	20.36%	26.60%	0.000***	
No game since last trading day	5392	17.92%	25.52%	0.000***	
Game since last trading day	1245	36.72%	31.90%	0.002***	closed > open
p-value : game > no game		0.000***	0.000***		

Panel B: Median price volatility by game outcome, annualized

Median price volatility (annualized)	Win	Draw	Loss	No game
Closed-market	31.15%	37.64%	53.99%	17.92%
Open-market	33.21%	30.11%	31.01%	25.52%
p-value : open > closed	0.986	0.052*	0.000***	0.000***
	closed > open	closed > open	closed > open	
Observations	677	306	262	5392
p-values : equal volatility to no game period				
p-value : game > no game (closed-market)	0.000***	0.000***	0.000***	
p-value : game > no game (open-market)	0.000***	0.039**	0.009***	

Appendix 12 Closed- and open-market price volatility by expected and actual game outcome – Germany, Holland, Italy, and Portugal

This table presents median volatilities based on expected and actual game outcomes for the sample period of August 1, 1998 to April 14, 2004. For example, the (upper-left) closed-market-win (0-0.75) cell presents median volatility for times when the market is closed and the club was mainly expected to lose but won. Volatilities for closed- and open-market periods are calculated from closing and opening prices. *p*-values for Mann-Whitney (U) tests for the differences between closed-market and open-market volatility, and between volatility for the periods that follow games, and do not follow games are also presented. The asterisks represent significance of tests of equal volatility over these periods compared to all periods when the market is closed and no games are played. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. These data are from Datastream database.

Median price volatility by expected and actual game outcome, annualized

	Expected result (points)					
Realised event	0 - 0.75	0.75 - 1.5	1.5 - 2.25	2.25 - 3	Grand Total All games	No game N/A
Win						
Closed-market	270.61%	39.84%	32.12%	26.19%	38.28%	17.92%
Open-market	66.30%	34.96%	31.81%	36.87%	32.26%	25.52%
p-value : open > closed	0.317	0.145	0.700	0.040**	0.002***	0.000***
	closed > open	closed > open	closed > open		closed > open	
p-value : game > no game (closed-market)	0.086	0.000***	0.000***	0.000***	0.000***	
p-value : game > no game (open-market)	0.254	0.053*	0.004***	0.000***	0.000***	
Observations	1	93	318	174	1081	5392
Draw						
Closed-market	48.01%	29.19%	42.61%	49.96%		
Open-market	53.52%	33.41%	26.26%	27.88%		
p-value : open > closed	1.000	0.883	0.003***	0.443		
			closed > open	closed > open		
p-value : game > no game (closed-market)	0.387	0.000***	0.000***	0.000***		
p-value : game > no game (open-market)	0.996	0.129	0.368	0.322		
	no game > game					
Observations	2	94	151	25		
Loss						
Closed-market	59.67%	58.67%	53.96%	85.43%		
Open-market	25.45%	33.77%	29.69%	23.28%		
p-value : open > closed	0.054*	0.001***	0.004***	0.412		
	closed > open	closed > open	closed > open	closed > open		
p-value : game > no game (closed-market)	0.012**	0.000***	0.000***	0.007***		
p-value : game > no game (open-market)	0.459	0.075*	0.150	0.297		
	no game > game					
Observations	6	112	94	11		